



Turkey's advanced R&D inspires tomorrow's innovations

Credit: Meg Jerrard, Unsplash

By Alex Talavera and Randy B. Hecht

Turkey banks on “innovation active” enterprise and technology to strengthen its economic and foreign commerce potential.

“One of our principles is to render the state active in the enterprises that are to the general benefit of the nation, especially in the economic field, in order to achieve a prosperous and well-cultivated country.”¹

Those contemporary-sounding words were actually spoken by Mustafa Kemal in 1923, the year Türkiye Cumhuriyeti—the Republic of Turkey—was founded. Better known as Kemal Atatürk and the country’s first president, he introduced a series of five-year industrialization plans in the 1930s.

Those plans evolved in the 1960s into five-year economic development plans that continue to serve as roadmaps for growth today. The current plan spans the years 2019–2023. It addresses a broad portfolio of economic aims, from agricultural production, rural employment, and poverty reduction to encouraging entrepreneurship and innovation, increasing energy efficiency, and employing digital transformation to boost productivity and competitiveness in priority sectors.²

In a 2018 speech that alluded to these priorities,³ President Recep Tayyip Erdoğan identified areas that he sees as key to securing Turkey’s future.

“Our technological depth, which we need in the areas of nanotechnology, materials, aviation, aerospace and defense, is growing with every passing day,” he said. “Initiatives regarding national technology will render it possible for us to grow stronger in economy and world politics.”

Tracking progress through a pandemic

Of course, like every other country, Turkey had no way of knowing that plans launched in 2019 would be sidetracked one year later by the COVID-19 pandemic—or that they would then be subjected to further risks from global inflation and the fallout of Russia’s war against Ukraine.

Perhaps in part resulting from these disruptions, there is a shortage of hard data measuring the impact of the current five-year plan on the country’s performance targets.

The Turkish Statistical Institute (TURKSTAT) published findings of a 2020 Innovation Survey in November 2021.⁴ (The next survey results will be published in November 2023.) According to the report, 67.3% of large companies (250 employees or more) and 38.5% of enterprises with 10 or more employees met the country’s “innovation active” standard during the survey period of 2018–2020. It also notes that 31.9% of companies in that category received public financial support, while 54.8% of those classified as “not innovation active enterprises” cites high costs as “the most hampering factor.”

In July, TURKSTAT published its annual analysis of “central government budget appropriations and outlays on R&D,” which it reported totaled TRY20,249,000,000 for 2021.⁵ That amount in Turkish lira converts to US\$1,113,348,742 at the exchange rate on August 27 and, according to the agency, represents 0.28% of Turkey’s Gross Domestic Product for the year. The report notes that this amount is slated to rise to TRY26,307,000,000 (US\$1,446,435,150) for 2022, “according to the provisional results based on initial budget appropriations.”

Universities received 48.3% of the total “for general advancement of knowledge,” while industrial production and technology were allocated just 10.3%. “According to the calculations based on the initial budget appropriations, it has estimated that the highest appropriation for R&D will be allocated to universities for general advancement of knowledge with 38.4% in 2022,” the report says, while the share for industrial production and technology will drop to 8.4%.

Officials at Turkey’s Ministry of Industry and Technology declined to respond to repeated requests for an interview or comments in connection with this article.

From campus to global commerce

The distributions of government funding for R&D create an environment in which the private sector must collaborate with universities.

“In Turkey, the universities are fairly flexible in the sense that they promote the faculty members to engage with industrial research,” says Ender Suvacı, founder and chief technology and innovation officer at Entekno Industrial Technological and Nanomaterials Co. (Eskişehir, Turkey). He also serves on the faculty at Eskişehir Technical University.

In an interview with the *Bulletin*, he explained that when Turkish companies need academic research support, they usually begin by contacting a university’s Technology Transfer Office, which is responsible for matching companies with the right person at the university. Industry can also make direct contact with their preferred researchers, but the Technology



Credit: Entekno Industrial Technological and Nanomaterials Co.

“Although we say we are in cosmetic and electronic applications, we are developing and manufacturing environmentally friendly and sustainable specialty particulate materials.” – Ender Suvacı, founder and chief technology and innovation officer at Entekno Industrial Technological and Nanomaterials Co.

Transfer Office usually gets involved regardless. Its role extends to negotiating ownership of technologies or patents that emerge from joint research, the number of days for which faculty members are contracted, and the amount the contracting company will pay for research activities and related expenses.

Intellectual property ownership may be put into a signed agreement at the beginning, but it can be left open at the outset, with the question to be revisited as the project achieves certain milestones.

“The main motivation to do this is not to put IP ownership negotiation in front of the collaboration,” Suvacı says. “They prefer to start, see the potential, and then discuss more.”

In either case, “academic entrepreneurship” is encouraged at Turkey’s universities, and private enterprise depends on academic research labs and facilities for access to equipment and tools and as a means of managing R&D investment expenses.

Connecting the ceramic microdots

Entekno’s portfolio includes inorganic powders, ceramic additives, and cosmetic additives. The business was launched as an outgrowth of research Suvacı conducted for an international company that sought his help developing size and shape controlled electroceramic particles that at the time were not commercially available and had to be produced in a laboratory. After they were developed, his collaboration partner wanted to increase production capacity, and with that decision, Entekno was born in 2008, initially as a university start-up.

The unifying factor in those three product lines is development of novel ceramic particle systems. “Although we say we are in cosmetic and electronic applications, we are developing and manufacturing environmentally friendly and sustainable specialty particulate materials,” Suvacı says. “We are tailoring particle systems, which have unique properties, and they make a significant impact wherever they are used.”

It was while he and his team were investigating novel zinc oxide forms that they realized they were one of the few nano zinc oxide manufacturers in the world.

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"While we were working in the area of electroceramics, we wanted to exploit how we could do something different with zinc oxide in a different sector, and we found out that zinc oxide is a great UV filter," Suvacı says. "With this technology, we were working in the electroceramic area, but we converted our particle synthesis-structure-property understanding to develop the new generation particle technology, which is called MicNo. Today, MicNo-ZnO particles are successfully commercialized in the global cosmetic industry."

Because MicNo has unique micron sized platelet morphology, it serves the company as a platform technology. Its use expanded in response to the COVID-19 pandemic when Entekno integrated antimicrobial and antiviral actives within the MicNo particles, which are called as MicNo-Hyg. The company then collaborated with sanitaryware manufacturing partners to create ceramic surfaces that exhibited broad-spectrum antimicrobial activity. "So far, seven million pieces of ceramic products have been produced by using MicNo-Hyg," Suvacı says.

He sees Entekno as an innovation company with a global scope. It serves customers on four continents and collaborates with them on research projects supported by a safety level-II microbiology lab and three product application laboratories on cosmetic formulations, hygiene, and piezoelectrics. In addition, the company prioritizes information-sharing that enables customers to easily adapt new technologies within their systems. Funding for projects has come not only from customers but also from the European Union and The Scientific and Technological Research Council of Turkey (TÜBİTAK). As an example, Entekno received an EU-funded Eurostar grant for

its collaboration with CTS Denmark on "development of new generation lead-free ceramics for consumer electronics."

Entekno also seeks innovation in its management of human resources. To that end, Suvacı and Entekno's managing partner Oktay Uysal are developing an Entekno Academy to provide ongoing internal training designed to promote professional development even for the 14% of his employees who hold doctorates. Suvacı mentions, for example, having a professor of microbiology deliver seminars on the biology of microorganisms and viruses to the Entekno team.

The Academy is expected to contribute to achieving business objectives, give existing employees a greater sense of purpose, and aid in attracting new candidates in a market with human capital constraints. Alongside that final point is Suvacı's goal of increasing the number of women who are hired by Entekno and supported in rising to executive positions at the company.

He also envisions training in methodologies and in developing employees' English-language skills so they are better equipped to serve global customers. Suvacı has a feeling of personal investment on that count, as he completed his master's degree and Ph.D. at The Pennsylvania State University, where "I met the wonderful world of ceramic powders. Really, that's how it started."

An "affordable luxury" import arrives

In July 2022, news broke that Eczacıbaşı Building Products (İstanbul, Turkey) would be expanding into the U.S. market. The company's announcement noted that its flagship brand,



In January 2022, Eczacıbaşı Building Products announced that VitrA received four new awards at Good Design Awards 2021. This award program, organized jointly by The Chicago Athenaeum: Museum of Architecture and Design and The European Centre for Architecture Art Design and Urban Studies, is one of the world's oldest and most prestigious design competitions. With these awards, VitrA now has 44 Good Design Awards. Pictured are the winning ArchiPlan bathroom collection and Atelier 01 tile series.

VitrA, has a 30% share of the market in Turkey but that exports generate most of its revenue.⁶

Although the U.K. and Germany are the company's two largest export markets, followed closely by France, its fastest-growing markets are China and India. But "you can't really consider yourself a global player unless you are in the United States," says Jeremy Cressman, who was named director of the Americas. The expansion plans also target Canada and perhaps Latin America.

In an interview with the *Bulletin*, Cressman noted that Eczacıbaşı Building Products has been a member of the UN Global Compact since 2006 and that this alignment is core to the brand's identity in other foreign markets. However, U.S. codes and standards, led by development in California and the Green Building Council, will be the company's targets to adhere to in this market.

These codes are not expected to introduce significant advances in water reduction. However, Cressman does expect them to make an impact in terms of the manufacturing process, materials used, material transparency, health product declarations, and environmental product declarations.

"Those are the basis for transparency in every aspect of supply chain and product development, from actual raw material extraction to conversion to how a ceramics piece is fired in the kiln and how much energy is consumed in doing that, to packaging, and its full cycle including recyclability, or reuse," Cressman says.

He also sees an opportunity for product distinction. "We're entering the markets here with kitchen sinks. And we're making kitchen sinks with fireclay. So an ancient process at high temperature to make the most durable ceramic piece you can make." Conversely, the company will not be offering composite sinks because "there is no way to call that a sustainable process."

The first products are expected to arrive in the U.S. in early November and will feature European styles and designers. Over the long term, Cressman expects that the portfolio will expand to reflect "design influences in the U.S. market, especially the kitchen and bath dealer designs, kitchen designers themselves, bathroom designers, and interior designers," he says.

"We don't have direct plans to work with anyone immediately. It is fair to say that it is on our roadmap," he says.

Looking ahead to 2023, he expects to introduce fireclay shower pans, which have been successful in Europe.

"These are heavy ceramic made at high temperatures, sizes up to 60 inch like an alcove tub, and they are nonslip, they are beautifully formed shape and texture," Cressman says. "The [U.S.] market tends to sell acrylic bases, or they tend to rely on the tile contractor to do a full waterproofing of a tile floor for the shower. These bases would be labor saving, as well as durable, heavy, and beautiful. It is a new product that would come to the U.S. sometime in late 2023."

Plans beyond that for next year are "very open at this point" but involve "looking for distribution partners in the affordable luxury area."

Pursuing multisector glass breakthroughs

Founded in 1935 under Atatürk's directive, Şişecam Group today has operations in 14 countries on four continents. In emailed responses to *Bulletin* questions, Glass Technologies Director İlkey Sökmen provided insights into the company's R&D priorities during the International Year of Glass and an overview of its future objectives and targets.

The company has a nearly half-century history of pioneering what it refers to as a "corporate R&D culture in Turkey." In 1976, it established one of the country's first private sector R&D centers, its Glass Research Laboratory in Istanbul. The LEED Gold-certified Şişecam Science, Technology, and Design Center launched in Kocaeli in 2014; the 9,400-square-meter facility houses 27 specialized laboratories staffed by 231 researchers whose areas of focus Sökmen described as "ranging from basic research to laboratory-scale pilot manufacturing trials."

With consolidated net sales of TRY40.2 billion (US\$2.4 billion) in the first half of 2022, the company made a total of TRY2.8 billion (US\$168 million) in investments for that period.*

"Şişecam allocates almost one percent of its turnover to R&D activities, carrying out joint projects in close contact and cooperation with numerous universities and research institutions in Turkey and around the globe," Sökmen wrote. "Şişecam is also engaged in pre-competitive collaboration with institutions and organizations operating in similar sectors, whenever needed."

How are the company's investment priorities evolving? Areas of concentration during the past five years include cold repairs, technology harmonization, acquisitions and new investments. Sökmen cited Şişecam's U.S. soda investment—which she noted is the largest-ever Turkish investment in the U.S.—as well as a Hungarian glass packaging facility (the company's first such plant in Europe), acquisition of the Italian refractory manufacturer Refel, and, on the domestic side, a further glass packaging investment in Eskişehir.



Developed by Şişecam Group, patented antimicrobial V-Block Technology is put on the market by Paşabahçe, Şişecam's leading glassware brand. The initial V-Block product range includes various tumblers, tea glasses and saucers, mugs, and bowls.

*The U.S. dollar amounts are calculated on the basis of the exchange rate as of the end of the first fiscal half, June 30, 2022, as reported on OANDA.com.

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The company also maintains float lines for architectural and automotive glass investments in Turkey. "With this investment, the current annual flat glass production capacity in Turkey will increase by 30%," Sökmen stated. In keeping with those projections, the company invested in "a new patterned glass furnace with a capacity of 600 tons per day and processing line with a capacity of 20 million square meters per year." This investment is designed to capitalize on emerging solar energy opportunities.

She added that as companies must comply with increasingly stringent sustainability regulations, Şişecam invested in Basalia Technology, a Turkish bio-economy invention that "converts all kinds of waste into harmless substances."

Integrating R&D and sustainability targets

Among studies underway at Şişecam are those focused on "production processes and value-added product development projects, especially for architecture, automotive, and renewable energy sectors, and important practices for efficient use of energy and reducing carbon footprint in all processes up to the end consumer," Sökmen wrote. These projects keep with the company's efforts to contribute to global achievement of net zero emissions by 2050.

"With this perspective, one of the most important trends in Şişecam R&D is recycling. Şişecam attaches great importance to all activities related to increasing the use of cullet in glass

production. Using 10% glass cullet in production, 2.5% energy saving can be ensured in the production of glass," Sökmen wrote.

Also in development: novel designs for next-generation glass furnaces to minimize and eventually phase out the use of fossil fuels. This work is in the study phase, with teams dedicated to such areas of investigation as integrated furnace models, improvement of heat transfer efficiency, new refractory materials, and new glass melting and production technologies. The company also introduced product innovations such as next-generation glass fiber products for wind turbine blade manufacturers that are made using advanced fiber production technology and reinforced with nanomaterials.

MARKET SNAPSHOT

Trade, treaties, and tariffs

Bicontinental Turkey relies on cross-border commerce, but U.S. export partners face some barriers to entry

By Alex Talavera and Randy B. Hecht



Next year marks the centennial of the Republic of Turkey, which emerged as the successor to the Ottoman Empire with the 1923 signing of the

Treaty of Lausanne (the final accord signed at the end of World War I). The country borders Bulgaria and Greece on the European side and Armenia, Georgia, Iran, Iraq, and Syria in Asia, but most of its boundaries are coastline: along the Black Sea to the north and the Aegean Sea to the west and south.

The CIA World Factbook rates Turkey as having an upper middle-income, diversified Middle Eastern economy. At the same time, it notes that an attempted coup in 2016 and a 2018 currency recession resulted in "economic instability" ahead of the COVID-19 pandemic, which sparked an increase in poverty and unemployment.^a

These economic woes were exacerbated in 2022 by skyrocketing inflation that Turkish government statistics acknowledged reached 78.6% as of June. However, *The Guardian* reported that "opposition parties and economists said recent hikes in oil and gas prices meant the real rate of inflation was almost double the official figure."^b The Russian invasion of Ukraine and its impact on trade in the Black Sea region pose additional economic and supply chain challenges.

Turkey's 2022 population is estimated to be 83,047,706, but less than 40% of the country was engaged in the labor force during 2021.

According to International Labour Organization data, the workforce was 32,618,920 that year; women comprised for 32.5% of the total, and children ages 7–14 accounted for another 2.6%.^c

In 2020, the real GDP (purchasing power parity) is estimated to have been \$2.394 trillion, or \$28,400 per capita.^a Leading industries in the country include textiles, food processing, automobiles, electronics, mining (coal, chromate, copper, boron), steel, petroleum, construction, lumber and paper. Within the agricultural sector, leading products are milk, wheat, sugar beets, tomatoes, barley, maize, potatoes, grapes, watermelons and apples. Natural resources found in abundance in Turkey include coal, iron ore, copper, chromium, antimony, mercury, gold, barite, borate, celestite (strontium), emery, feldspar, limestone, magnesite, marble, perlite, pumice, pyrites (sulfur), and clay.

Turkey operated at a trade deficit in 2020, with exports of \$203.29 billion against imports of \$232.01 billion. Leading export commodities include cars, vehicle parts, refined petroleum, delivery trucks, jewelry, clothing, and apparel, while gold, refined petroleum, crude petroleum, vehicle parts, and scrap iron are notable commodity imports. In 2019, the country's major trade partners included the United Kingdom, Iraq, Italy, and the United States for exports and Germany, China, Russia, the United States, and Italy for imports.

The Commerce Department's International Trade Administration cites Turkish government statis-

tics that show goods from the U.S. accounted for nearly 5% of total imports into Turkey in 2021. However, it adds this note of caution: "An increase in tariffs in 2018 and 2019 on a range of U.S. products may put some U.S. exporters at a disadvantage relative to their European competitors, who share a Customs Union agreement with Turkey and therefore do not face the same trade barrier."^d

Additional details and foreign commerce support are available via the International Trade Administration's Turkey Country Commercial Guide (<https://bit.ly/3TQjY02>), the U.S.–Turkey Business Council (<https://bit.ly/3esx9o3>) and the Turkish American Chamber of Commerce, Industry and Maritime Trade (<https://bit.ly/3erzwaL>).

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^bP. Inman, "This article is more than 2 months old Turkey hit with soaring prices as inflation nears 80%," *The Guardian*. 4 July 2022. Accessed 6 Sept. 2022. <https://www.theguardian.com/business/2022/jul/04/turkey-hit-with-soaring-prices-as-inflation-reaches-24-year-high-erdogan>

^cInternational Labour Organization, "Labor force with advanced education, male (% of male working-age population with advanced education) – Turkiye," The World Bank. Data as of June 2022. Accessed 6 Sept. 2022. <https://data.worldbank.org/indicator/SL.TLF.ADVN.MA.ZS?locations=TR>

^d"Turkey – Country Commercial Guide," U.S. Commerce Department International Trade Administration. Last updated 26 July 2022. Accessed 6 Sept. 2022. <https://www.trade.gov/country-commercial-guides/turkey-market-overview> ■

The COVID-19 pandemic inspired the invention of “a special coating that neutralizes viruses and bacteria on glass surfaces,” Sökmen wrote. “Patented Antimicrobial V-Block Technology, developed by Şişecam, aims to prevent the spread and reproduction of viruses and bacteria that can be transmitted by person-to-person contact on glassware.”

In 2021, Şişecam collaborated with 45 Turkish and 39 international universities, research institutions, and private sector R&D units. It sees Ph.D. programs as essential to providing qualified researchers for ongoing projects. Sökmen noted that as a result of the company’s collaborations with seven universities, “we have nine projects, which will result in the employment of 23 doctorates.”

This year, Şişecam’s 37th annual International Glass Conference has the theme “Inspiration for Tomorrow: Celebrating International Year of Glass.” It will be conducted in a hybrid format

November 17–18, with onsite activities held in Istanbul.

“Inspiration for Tomorrow” could also be Turkey’s national economic development slogan. The country envisions a future born of “innovation active” entrepreneurship and technological advances—but it must navigate today’s economic uncertainties and supply chain challenges to get there.

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⁴“Innovation Research, 2020,” Turkish Statistical Institute. 24 Nov. 2021. Accessed 6 Sept. 2022. <https://data.tuik.gov.tr/Bulten/Index?p=Innovation-Survey-2020-37457>

⁵“Appropriations and Expenditures from the Central Government Budget for R&D Activities, 2022,” Turkish Statistical Institute. 19 July 2022. Accessed 6 Sept. 2022. <https://data.tuik.gov.tr/Bulten/Index?p=Central-Government-Budget-Appropriations-and-Outlays-on-RvD-2022-45702>

⁶“Leading ceramics producer Vitra sets sights on thriving US market,” *Newsfile*. 13 July 2022. Accessed 6 Sept. 2022. <https://www.newsfilecorp.com/release/130362/Leading-Ceramics-Producer-Vitra-Sets-Sights-on-Thriving-US-Market> ■

Policy and product development

TÜBİTAK: Turkey’s national institute for science and technology R&D

By Alex Talavera and Randy B. Hecht

The Scientific and Technological Research Council of Turkey, or TÜBİTAK, is the Turkish government’s advisory agency on science and research and the Secretariat of the Supreme Council for Science and Technology. Its board members are drawn from a mix of academia, industry, and research institutions.

In addition to fulfilling its science and technology policy-making responsibilities, the organization manages R&D institutes in line with national priorities. Its description of the scope of its work states that TÜBİTAK “funds research projects carried out in universities and other public and private organizations, conducts research on strategic areas, develops support programs for public and private sectors, publishes scientific journals, popular science magazines and books, organizes science and society activities, and supports undergraduate and graduate students through scholarships.”

Affiliated institutes are organized under two TÜBİTAK organizational bodies.

• The Marmara Research Center (MAM) oversees eight divisions: Environment and Cleaner Production, Energy Institute, Genetic Engineering and Biotechnology, Food Institute, Chemical Technology Institute, Polar Studies Institute,

Materials Institute, and Institute of Earth and Marine Sciences.

• The Information and Information Security Advanced Technologies Research Center (BILGEM) oversees five divisions: Information Technologies, Advanced Technologies Research Institute, Cyber Security, National Electronics and Cryptology Research, and Software Technologies Research Institute.

The Materials Institute’s research encompasses (critical) metallic and structural materials and sensor materials and systems (e.g., photonic technologies, CBRN sensors, acoustics, lasers, medical devices, nanomaterials and coatings, and millimeter wave and terahertz technology). MAM maintains a research project list at <https://bit.ly/3RsGCdK>, but it has not been updated since 2020.

TÜBİTAK reports that as of 2022, it

has bilateral cooperation agreements with 92 institutions from 65 different countries. These agreements cover joint research projects as well as scientific meetings and scientist exchanges and visits. Links to information about existing programs are listed at <https://bit.ly/3RK8Sbv>.

Hasan Mandal, chairman of TÜBİTAK and of its Board of Directors, completed his Ph.D. and post-doctoral studies at Newcastle University in the United Kingdom. He began his career as a professor of ceramic engineering and is a member of the World Academy of Ceramics and a former president of the European Ceramic Society. Mandal declined to respond to repeated requests for an interview in connection with this year’s international report. ■



The 53rd award ceremony for TÜBİTAK’s Research Project Contest for High School Students was held in June 2022. President Recep Tayyip Erdoğan, center, spoke at the ceremony and highlighted the work his administration has done to transform and improve the Turkish education system.

Credit: Republic of Turkey Ministry of National Education

Turkey's advanced R&D inspires tomorrow's innovations

Directory of Turkish companies, associations, institutes, government agencies, and universities *All links included in this directory worked as of Sept. 1, 2022*

CORPORATIONS

Ahenksan Metal

Mimarsinan Organize Bölgesi, 23. Cadde, No: 82, Melikgazi, Kayseri

Phone: 90-352-503-0166

Website: <https://www.ahensan.com>

Contact: info@ahensan.com

The company manufactures and supplies a product line that includes acrylic, cement, ceramic, chromate, copper, duplex, lime, metal, mold, refractory, rubber, and surface coatings.

Akcoat

Sakarya 2. OSB No. 1 Road No:18 54300 Hendek, Sakarya

Phone: 90-264-323-3031

Website: <https://www.akcoat.com>

Email: akcoat@akcoat.com

The company's five primary product groups are enamel, ceramic, nonstick decorative coatings, pigment, and glass.

Burcam

Yenicek y, Yenicek y Mh Fatih Sultan Mehmet Han Blv.

Burcam Blok, D:No:1, 16440 İneg l, Bursa

Phone: 90-224-718-6056

Website: https://burcam.com.tr/en/en_en

Email contact form: <https://burcam.com.tr/en/contact>

The company's glass services encompass cutting, drilling, rodaging and sandblasting processes, CNC channel and processing, bizote and form operation, and screen and digital printing processes.

Burmas

Şirinevler Mh. Ankara Cd. No:743 Yıldırım, Bursa

Phone: 90-224-341-3316

Website: <http://burmas.com.tr>

Email: export@burmas.com.tr

Ç ylen Cam

Phone: 90-384-213-1464

Website: www.colyencam.com.tr

Email: info@colyencam.com.tr

Established in 1973 to serve wholesalers and retailers in the glass sector, the company's products include insulating glass materials, double glass, tempered glass, glass processing, and jumbo sizing machines.

Entekno Industrial Technological and Nanomaterials Co.

Yesiltepe Mah. Ismet Inonu-2 Cad. No:2/57 Tepebasi, Eskisehir

Phone 90-541-320-3677

Website: <https://www.enteknomaterials.com>

Email: info@enteknomaterials.com

Entekno was founded in 2008 "to develop and produce advanced materials and/or technologies and to realize the usage of these materials into real applications." With a focus on how nano particle solutions can be developed to benefit society, the company developed its MicNo® ZnO particle technology for broad-spectrum protection against UV rays.

R&D teams at Entekno explore a variety of fields of science and technology, including production of inorganic powder materials, modification of powder surfaces, composite materials production and development, improvement of physical, chemical, and thermochemical properties of materials and nanomaterials synthesis and development. Its projects include development of lead-free piezoelectric ceramics, safe nanomaterials synthesis, textured advanced ceramics production, high-purity materials production, flame retardant materials production, and production of nanoadditives for nanocomposites.

In addition, Entekno produces inorganic powders, including barium titanate, strontium titanate, barium carbonate, bismuth oxide, tantalum pentoxide, and aluminium hydroxide.

ESAN

Kyrenia Mah. River St. No: 1-3 Maltepe, 34852, Istanbul

Phone: 90-216-581-6400

Website: <https://www.esan.com.tr/tr/tarihce>

Email contact form: <https://www.esan.com.tr/tr/iletisime-gecin>

Founded in 1978, Esan's refractory activities encompass industrial minerals (production and commercial products), metallic mines, laboratory services and engineering, and consultancy.

Eczacıbaşı Building Products

Kanyon Office Büy kdere Caddesi 185 Levent 34394, Istanbul

Phone: 90-212-371-7000

Website: <https://www.eczacibasi.com.tr/tr/anasayfa>

Email contact form: <https://www.eczacibasi.com.tr/tr/iletisim>

Etiler Madencilik A.Ş.

Aşık Veysel, Buğday Sk. No:11 D:B Blok, 34707 Ataşehir, Istanbul

Phone: 90-216-688-3900

Website: <https://www.etilermadencilik.com.tr/en>

Email: info@etilermadencilik.com.tr

The company produces "all-in (raw) and drained (refined) clay for the needs of domestic and foreign ceramic industry" and has "an annual production capacity of 750 thousand tons of refined clay and 12 thousand tons of raw clay." Its white silica sand "is prepared in a washing plant equipped with modern equipment" and is available in bulk or in smaller quantities. The company maintains its own R&D facilities and labs to provide Q&A oversight on raw materials specifications and production.

Kaleseramik Çanakkale Kalebodur Seramik San. Inc. (Kale)

Büy kdere Cad.Kaleseramik Building 34330 Levent, Istanbul

Phone: 90-212-371-5253

Website: <https://www.kale.com.tr>

Email: iletisim@kale.com.tr

Kümaş Magnesite Industry Inc.

Barbaros Mah. Kardelen Sk. Palladium Tower Blok No:2 Inner Door No:27 Ataşehir, Istanbul

Phone: 90-216-576-2011

Website: <http://www.kumasref.com/tr-TR>

Email contact form: http://www.kumasref.com/iletisim_PG_1.html

Drawing on the natural magnesite ore found in Turkey's Kütahya-Eskişehir-Bilecik triangle, the company launched in 1972 to produce sinter magnesite, basic refractory bricks and mortar, iron-steel, and cement. It began fused magnesite production in 2008 and today also supplies fused magnesite, fused oxochrome, and calcined magnesite derivative products as industrial raw materials. In addition, its factory manufactures magnesite, dolomite, and alumina refractory bricks and mortars.



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All links included in this directory worked as of Sept. 1, 2022

Matel Hammadde Sanayi ve Ticaret A.Ş.

Yalı Mahallesi, Ziya Gökalp Cad. No: 3 34844 Maltepe, İstanbul

Phone: 90-216-441-2283

Website: <https://www.matel.com.tr/tr/urun>

Email: matel@materl.com.tr

The company's Clay Group produces refined clays as well as clays for tiles and sanitaryware. Its Feldspar Group produces K- and Na-feldspars as well as syenite. The Kaolin and Quartz and Silica Groups round out the organization. The website notes that the company's laboratory is "capable of conducting all analyses required for ceramic industry and all kinds of chemical, mineralogical and physical analyses in Bilecik. In the laboratory, we perform required in-company quality controls and also meet the laboratory demands of other companies in the region and conduct intensive R&D works on industrial raw materials."

MDA Advanced Technology Ceramics Inc.

Organized Industrial Zone Technology Boulevard, Eskisehir

Phone: 90-222-236-1880

Website: <https://mdaceramic.com/#>

Email: info@mdaceramic.com

Miltas Nano

İstanbul Anadolu Yakası O.S.B Gazi Bulvarı, No: 51/A, Tuzla, İstanbul

Phone: 90-216-593-1303

Website: <https://nanomiltas.com>

Email: info@nanomiltas.com

The company develops complex nanomanufacturing systems that can produce nanoparticles, nanofibers, and a combination of the two. It uses a hybrid technology developed using magnetic field atomization techniques.

Nanografen

GOSB Technopark 1st Production Building, Unit 5, Gebze, Kocaeli

Phone: 90-262-678-8900

Website: <http://nanografen.com.tr>

Email: info@nanografen.com.tr

The company's mission statement says, "We offer robust, reliable, cost-effective, and fast processes for upscaling graphene, improve thermal stability, electrical conductivity, and mechanical properties of composite materials by using graphene in polymer matrix and provide significant weight reduction in materials. We decrease the risks of plastic materials on environment by increasing the use of carbon technologies and produce value-added graphene based materials by recycling of organic and inorganic waste."

Polat Mining Industry and Trade Inc.

Büyükdere Cad. Polat Han No:87 34387 Mecidiyeköy, İstanbul

Phone: 90-212-213-6095

Website: <https://www.polatmaden.com.tr>

Email: polamaden@polatholding.com

The company's products include granular and micronized quartz, micronized and broken Na-feldspar, and ceramic clays.

Şişecam

İçmeler Mah. D-100 Karayolu Cad. No:44A 34947 Tuzla, İstanbul

Phone: 90-850-206-5050

Website: <https://www.sisecam.com.tr/en>

Email contact form: <https://www.sisecam.com.tr/en/contact-us/contact-us>

In addition to being a prominent global player in the glass industry, the company maintains business lines in soda and chromium compounds and announced further expansion of its operations in February 2022 with the acquisition of Italian refractory manufacturer Refel. Şişecam's production operation span 14 countries on four continents, and its customers are located in 150 countries worldwide. Its areas of business include flat glass, glassware, glass packaging, automotive glasses, and glass fiber as well as in soda and chromium compounds.

- Environment, Biodiversity, and Climate Change
- Energy
- Food and Nutrition
- Cancer
- Stem Cell
- Health Sciences and Technologies
- Sustainable Environment and Finance

TÜBİTAK

The Scientific and Technological Research Council of Turkey

Tunus Caddesi No:80 06680 Kavaklıdere, Ankara

Phone: 90-312-468-5300

Website: <https://www.tuba.gov.tr/en>

Contact: ozelkalem@tubitak.gov.tr

Marmara Research Center website: <https://mam.tubitak.gov.tr/en>

Contact: MAM.bilgi@tubitak.gov.tr

ASSOCIATIONS, INSTITUTES, AND GOVERNMENT AGENCIES

Ministry of Energy and Natural Resources

Türk Ocağı Street No:2 06520 Çankaya, Ankara

Phone: 90-312-546-4646

Website: <https://enerji.gov.tr/homepage>

Turkey's natural resources include coal, iron ore, copper, chromium, antimony, mercury, gold, barite, borate, celestite (strontium), emery, feldspar, magnesite, perlite, pumice, pyrites (sulfur), and clay. The Ministry website reports that Turkey "has approximately 40% of the world's natural stone reserves," including marble, travertine, and granite. "Main natural stone types consist of crystalline limestone (marble), limestone, travertine-formed limestone (onyx), conglomerate, breccia, and rocks of magmatic origin (granite, syenite, diabase, diorite, serpentine, etc.)."

Ministry of Industry and Technology

Mustafa Kemal District Dumlupınar Boulevard (Eskişehir Road 7.km) 2151. Street No:154/A 06530 Çankaya, Ankara

Phone: 90-312-444-6100

Website: <https://www.sanayi.gov.tr/anasayfa?lang=en>

Contact: info@sanayi.gov.tr

SERFED

Turkish Ceramics Federation

Ataturk Mah. Namik Kemal Cad. Ekincioglu Sok. No:44/1 Atasehir, İstanbul

Phone:90-216-629-0100

Website: <https://www.serfed.com>

Contact: info@serfed.com

Member associations include:

- SERKAP (Ceramic Tile Manufacturers Association)
- SERSA (Ceramic Sanitary Ware Manufacturers Association)
- SERHAM (Ceramic, Glass and Cement Raw Materials Manufacturers Association)
- SEREF (Technical Ceramics and Refractory Manufacturers Association)
- EBK (Eskişehir Bilecik Kütahya Ceramic Business Cluster)
- TSD (Turkish Ceramics Association)

TÜBA

Turkish Academy of Sciences

Vedat Dalokay Caddesi No: 112 Çankaya 06670 Ankara

Phone: 90-312-442-2903

Website: <https://www.tuba.gov.tr/en>

Contact: tuba@tuba.gov.tr

The Academy, which marked its 30th anniversary in September 2022, is the umbrella organization for the following working groups:

- Science and Education Policies
- Information Technologies and Communication



Turkey's advanced R&D inspires tomorrow's innovations

Directory of Turkish companies, associations, institutes, government agencies, and universities *All links included in this directory worked as of Sept. 1, 2022*

TurkishGlass

Ceyhun Atf Kansu St. N: 20 Balgat, Ankara

Phone: 90-312-447-2740

Website: <https://www.turkishglass.org>

Email: info@turkishglass.org

TurkishGlass is the association representing the glass manufacturers, glass processors, and glass exporters in Turkey. Exports of Turkish glass are delivered to 175 countries each year. This professional association is focused predominantly on flat glass, glassware, and glass packaging.

UNIVERSITIES

Bilkent University

Website: <https://unam.bilkent.edu.tr/en>

Institute of Materials Science and Nanotechnology (UNAM)

Director: Hilmi Volkan Demir

Phone: 90-312-290-2513

Email: unam@unam.bilkent.edu.tr

The university is home to Turkey's National Nanotechnology Research Center, the Institute of Materials Science and Nanotechnology. UNAM is described on the website as a multidisciplinary organization that "incorporates over 10 laboratories with distinct interests, united only by their shared interest in cutting-edge nanotechnology research. Each research group focuses on a certain aspect of nanoscale phenomena, varying from biotechnology to fiber optics, but research at UNAM falls under eight general categories (optics, photonics, materials science, nanobiotechnology, neuroscience, computational nanotechnology, micro & nanofluidics, MEMS & NEMS, and two-dimensional materials)." A full list of areas of research with links to each research team's page can be found at unam.bilkent.edu.tr/en/research-fields.

Istanbul Technical University

İTÜ Ayazağa Campus, Rectorate Building, 34469 Maslak, Istanbul

Phone: 90-212-444-1488

Website: <https://www.itu.edu.tr/en>

Email: ardek@itu.edu.tr

Koç University

Rumelifeneri Yolu 34450, Sariyer, Istanbul

Phone: 90-212-338-1000

Website: <https://www.ku.edu.tr/en>

Email: information@ku.edu.tr

The website contains limited English-language information about the university's fields of research. But a faculty page for Seda Keskin Avcı offers access to additional detail (<https://mysite.ku.edu.tr/skeskin>). She holds three positions at the university: professor in the Chemical and Biological Engineering Department; associate dean for research in the College of Engineering; and director of the Nanomaterials, Energy and Molecular Modeling Research Group (NEMO). She can be reached by phone at 90-212-338-1362 or by email at skeskin@ku.edu.tr.

Marmara University

Center for Nanotechnology & Biomaterials Applications and Research

Göztepe Campus 34722 Kadıköy, Istanbul

Phone: 90-216-777-0000

University website: <https://www.marmara.edu.tr>

Center for Nanotechnology & Biomaterials Applications and Research website: <https://nbuam.marmara.edu.tr/en/research/research-area>

Email: nano@marmara.edu.tr, oguzhan@marmara.edu.tr

Marmara University is home to the Center for Nanotechnology & Biomaterials Applications and Research, whose fields of inquiry fall within several categories: nanotechnology research, controlled drug release systems and smart nanofiber and nanoparticles; nanostructured composite materials, tissue engineering products and biomaterials; and 3-dimensional biography and production of medical diagnostic materials.

The Center's research teams have been awarded patents in Turkey, Europe, and the U.S., and patent applications now under review include *Osteogenic Osteoconductive Biocompatible Composite Nanofiber Scaffold for Repair of Bone and Cartilage Tissue Damage* (Oğuzhan Gündüz, Sabri Altıntaş, Mustafa Şengör, Hasan Bedir, and Güneş Ece Akalın) and *A Production Method for a Viable Cell Loaded Polymer/Enzyme Hydrogel and an Artificial Cornea Layer Produced by Said Method* (Songul Ulag, Mustafa Sengor, Ahmet Zeki Sengil, Nazmi Ekren, and Oguzhan Gunduz).

Middle East Technical University

Üniversiteler Mahallesi, Dumlupınar Bulvarı No:1 06800 Çankaya, Ankara

Phone: 90-312-210-2000

Website: <https://www.metu.edu.tr>

Email and phone directory: <https://www.metu.edu.tr/contact-info>

The university offers an undergraduate and graduate degrees in metallurgical and materials engineering and graduate programs in cement engineering, micro and nanotechnology, and polymer science and technology.

Sabancı University

Phone: 90-216-483-9600

Website: <https://www.sabanciuniv.edu>

Website: <https://fens.sabanciuniv.edu/tr>

Email (Graduate Office): su-fens-gradoffice@sabanciuniv.edu

Email (Dean's Office): fensinfo@sabanciuniv.edu

The Faculty of Engineering and Natural Sciences offers undergraduate and graduate degrees in materials science and nano engineering.

Yıldız Technical University

Barbaros Bulvarı 34349, Yıldız, Istanbul

Phone: 90-212-383-7070

Website: <https://yildiz.edu.tr>

Website: <http://www.met.yildiz.edu.tr>

Email directory page: <https://yildiz.edu.tr/rehber>

The university describes itself as prioritizing "R&D studies focusing on future technologies" (in particular, defense technologies, clean energy, biotechnology and digital technologies) and quantifies its R&D performance in terms of publications, projects and entrepreneurship studies. Its Technology Transfer Office, located in YTU Yıldız Technopark, "acts and an interface for the use of academic knowledge, science and know-how... in line with the needs of industry."

Its Department of Metallurgical and Materials Engineering is equipped with laboratories with the following research capabilities: casting, electron microscopy, raw material and mineral processing, heat treatment, chemical analysis, composites, corrosion, mechanical inspection, metallurgical pretreatment and production metallurgy, microscopy and metallurgy, plastic forming, ceramics, powder metallurgy, biomaterials, polymeric materials, and glass research. ■

