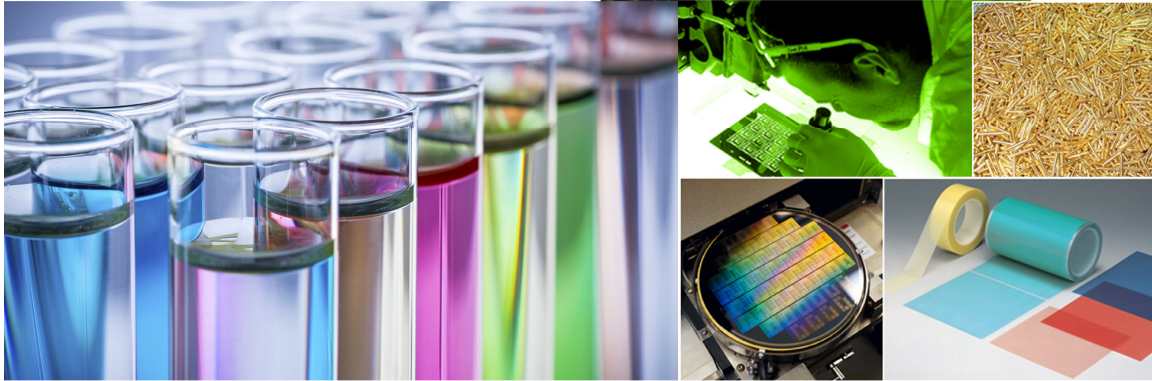


THE ELECTRONIC MATERIALS REPORTER

SECOND QUARTER • AUGUST 2023



- This is the Q2 2023 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue reviews year-to-date market developments, highlights the fastest-growing electronic materials segments, and focuses on a review of several materials segments: semiconductor packaging, interconnect materials, battery materials, and board-level and systems-level assembly materials.
- Prismark has **revised downward its electronic materials estimate for 2023**. After a weak first half of the year, the combination of weak end demand, price declines, inventory destocking and some currency effects continues to dampen the growth prospects for 2023. We now expect the electronic materials market in total to grow only 0.4% in 2023 over 2022. Growth in energy materials (+6%) is expected to be largely offset by a decline in conventional materials (-6%).
- **High-growth opportunities** remain available across various segments of the materials market. Some 20 distinct materials are expected to offer growth rates of at least 6% CAAGR from 2022 to 2027.
- After some strong years during the pandemic, the **semiconductor packaging** materials segment is now once again held back by miniaturization and the adoption of materials-poor advanced package types. Prismark expects growth at less than 3% CAAGR (2022-2027).
- The **interconnect materials** segment faces another down year in 2023, but the mid-term outlook is slightly faster than systems growth. Prismark expects over 4% CAAGR (2022-2027).
- After almost doubling in each of the preceding two years, the **battery materials** segment is now facing somewhat more modest EV unit growth as well as some drastic raw materials price declines in 2023. Even so, battery materials remain the fastest-growing segment at 15% CAAGR (2022-2027).
- **Materials for PCB and systems assembly** are expected to grow at just over 3% CAAGR in the mid-term, close to systems growth with some attenuation from price erosion and efficiencies.

THE ELECTRONIC MATERIALS REPORTER

FIRST QUARTER • MAY 2023



- This is the Q1 2023 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue is focused on the review and forecast of the electronic materials market, segmented by application space.
- The electronic materials market grew 25% in 2022 over 2021 by Prismark's revised estimate, reaching a value of \$276Bn. This headline number conceals the wide disparity between fast growth in the battery materials and PV materials segments (together, +73% YoY) and a decline of -3.6% in conventional electronic materials.
- Currency exchange rate fluctuations had a noticeable impact in 2022, reducing the total electronic materials market size by about 3%. Commodity price fluctuations, on the other hand, had almost no impact, with price changes for copper, tin, silver, gold, and cobalt largely offsetting one another. One important exception was lithium precursor pricing, which gained significantly and boosted revenues of battery materials.
- Among conventional electronic materials, the wafer fabrication materials segment was the only one to grow year over year in 2022. All other conventional segments declined, following the underlying electronic systems trend.
- For 2023, Prismark expects a much more modest 3.4% growth for the overall electronic materials market. This includes a -2.6% decline for conventional electronic materials segments (with downside potential, depending on recovery timing), and comparatively modest growth of 9% for battery and PV materials—much slower than in recent years.
- Prismark's mid-term outlook for the electronic materials market stands at 7.1% CAAGR overall from 2022 to 2027. This includes 3.8% CAAGR for the conventional materials, similar to the expected electronic systems growth rate. Energy materials are forecasted to grow at 10% CAAGR over the period, held back by the extremely strong 2022 baseline.
- Apart from large, fast-growing segments such as battery materials, smaller fast-growing niches exist in almost all segments. Other growth strategies for electronic materials suppliers include market share gains through innovation and focused commercial efforts, finding new applications for existing technologies, and consolidation or acquisitions to expand product portfolios.

THE ELECTRONIC MATERIALS REPORTER

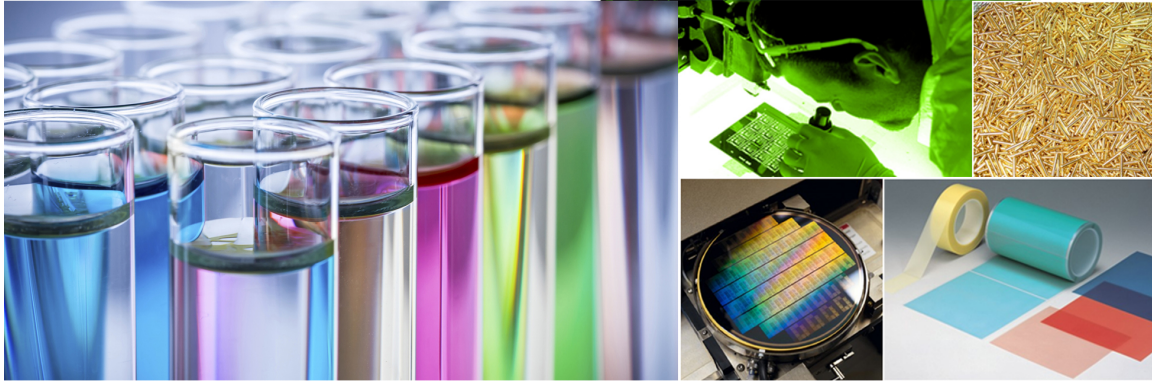
FOURTH QUARTER • FEBRUARY 2023



- This is the Q4 2022 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue provides initial estimates for full-year 2022 and an outlook for 2023, and focuses on a review of several materials segments: semiconductor wafer fabrication materials, display fabrication materials, photovoltaics materials, and materials used in the fabrication of other components.
 - Semiconductor **wafer fabrication materials** grew 13% (preliminary) to \$38Bn in 2022. This materials growth was largely driven by wafers and photomasks, with most other materials growing at a slower pace. Prismark's segment growth outlook stands at just over 6% CAAGR 2021-2026.
 - The **display materials** market declined along with the underlying display panel market, contracting by almost 12% in 2022 (preliminary). The 2021-2026 growth outlook stands at 1.5% CAAGR. Lack of substantial unit growth in PCs, phones, and TVs limits the growth prospects.
 - **PV materials** followed the same pattern as in the previous year: solid volume growth and higher materials prices led to 53% growth over 2021, reaching \$58Bn. As PV wafer pricing in particular normalizes, the mid-term outlook is much more modest at 11% CAAGR from 2021-2026, with most of that growth having already happened in 2022.
 - The "**Other components**" materials segment includes materials for passives, connectors, and data storage components. These three subsegments varied greatly in their 2022 performance. In aggregate, this materials segment declined 3% YoY. The five-year outlook stands at 3% CAAGR (2021-2026).
- Prismark's preliminary estimate for full-year 2022 electronic materials market growth stands at 22% over 2021. Battery and PV materials together grew over 60%, while conventional materials declined about 2%. Energy materials now account for just under half of the total electronic materials market. For 2023, our current estimate calls for much more modest 9.3% year-over-year electronic materials market growth in total, with conventional electronic materials growing only 0.5%.

THE ELECTRONIC MATERIALS REPORTER

THIRD QUARTER • NOVEMBER 2022



- This issue of the *Electronic Materials Reporter* surveys the leading electronic materials suppliers.
- We profile the top 50 electronic materials suppliers by revenue during calendar year 2021. The electronic materials business of the largest supplier (Shin-Etsu) reached \$5.5Bn by Prismark's definitions. In total, the top 50 suppliers generated some \$121Bn in electronic materials sales during the year.
- The battery and PV materials segments showed particularly strong growth in 2021. This is reflected in a large number of related materials suppliers that either moved up the rankings or joined the Top 50 list for the first time.
- The prevalence of Asian (and particularly Chinese) materials suppliers in the fast-growing battery and PV segments has caused the revenue share of Asian-headquartered companies to jump from 30% to 42% in 2021. Conversely, the revenue share of long-dominant Japanese-headquartered companies dropped from 44% to 35%.
- The electronic materials market as a whole remains fragmented. The top 50 suppliers identified here represent only 56% of the total electronic materials market.
- In contrast, some individual market segments are highly concentrated. This may result where a small number of customers demand large materials volumes, and where the need for access to financial and technology resources creates barriers to entry.
- The electronic materials forecast for 2022 has been revised upward to 22% growth over 2021, mainly due to pricing effects in battery materials. Conventional electronic materials are expected to contract by -2.3%. The initial outlook for 2023 is for a modest recovery.

THE ELECTRONIC MATERIALS REPORTER

SECOND QUARTER • AUGUST 2022



- This is the Q2 2022 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue reviews year-to-date market developments, highlights the fastest-growing electronic materials segments, and focuses on a review of several materials segments: semiconductor packaging, interconnect materials, battery materials, and board-level and systems-level assembly materials.
- Prismark has **revised upward its electronic materials estimate for 2022**, with declining prospects in conventional electronic materials more than offset by stronger growth in battery and PV materials. We now expect the materials market in total to grow 12.7% in 2022 over 2021. However, conventional materials (excluding battery and PV materials) are expected to decline at -2.1%, similar to Prismark's revised electronic systems forecast.
- **High-growth opportunities** remain available across various segments of the materials market. Some 20 distinct materials are expected to offer growth rates of at least 6% CAAGR from 2021 to 2026.
- The **semiconductor packaging** materials segment had two strong years in 2020-2021, but is now expected to return to more modest growth at 1.9% CAAGR from 2021 to 2026. The segment is held back by miniaturization and the adoption of materials-poor advanced package types.
- The **interconnect materials** segment had an extremely strong year in 2021, with 34% growth. This high baseline now reduces the growth outlook through 2026 to only 1.6%. Materials related to IC package substrate production offer the fastest growth prospects.
- The **battery materials** segment is by far the fastest-growing segment of the electronic materials market. Rapid adoption of electric vehicles is expected to drive battery materials growth at 21% CAAGR through 2026.
- **PCB and systems assembly materials** are expected to grow at 2.5% CAAGR, held back by the high 2021 baseline as well as the segment's dependence on a number of quasi-commoditized materials.

THE ELECTRONIC MATERIALS REPORTER

FIRST QUARTER • MAY 2022



- This is the Q1 2022 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue is focused on the review and forecast of the electronic materials market, segmented by application space.
- The electronic materials market grew 33% in 2021 over 2020, reaching a value of \$217Bn. Growth was boosted by the battery materials and PV materials segments: excluding these segments, growth was 17.5%.
- Commodity price increases had a significant impact in 2021. Price increases for copper, tin, silver, gold, and cobalt contributed about 4% to overall electronic materials revenues. Other commodities such as silicon metal or lithium precursors contributed a similar amount. Currency exchange rate fluctuations similarly made a positive contribution to the materials market growth, estimated at about 2%.
- Except for display materials, all materials segments showed solid double-digit growth. Battery materials were the leader at 97% growth, followed by PV materials at 47%, and interconnect materials at 34% growth.
- For 2022, Prismark expects a much softer year with a moderate 3% growth across the traditional electronic materials segments, reflecting the slower electronics systems growth outlook. Including battery and PV materials, we forecast 12% growth for the total electronic materials market.
- The mid-term outlook for the electronic materials market stands at 7.6% CAAGR 2021 – 2026. Excluding the battery and PV materials segments, the forecast for the remaining traditional electronic materials segments would be 3.3% CAAGR, partly held back by the strong 2021 comparison baseline.
- Apart from large, fast-growing segments such as battery materials, smaller fast-growing niches exist in almost all segments. Other growth strategies for electronic materials suppliers include market share gains through innovation and focused commercial efforts, finding new applications for existing technologies, and consolidation or acquisitions to expand product portfolios.

THE ELECTRONIC MATERIALS REPORTER

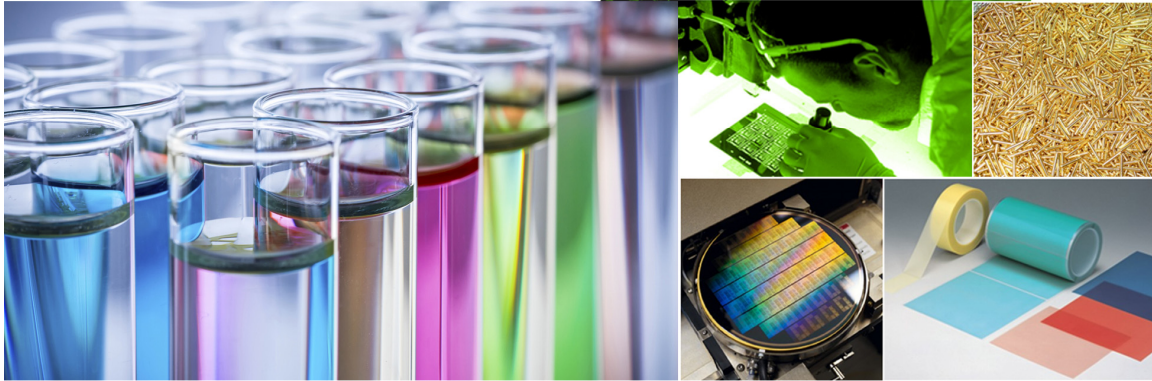
FOURTH QUARTER • FEBRUARY 2022



- This is the Q4 2021 issue of Prismark's **Electronic Materials Reporter (EMR)**. This issue provides initial estimates for full-year 2021 and an outlook for 2022, and focuses on a review of several materials segments: semiconductor wafer fabrication materials, display fabrication materials, photovoltaics materials, and materials used in the fabrication of other components.
 - Semiconductor **wafer fabrication materials** grew over 16% to \$32.9Bn in 2021. This materials growth was driven by well over 20% IC unit growth. Prismark's segment growth outlook stands at 6.6% CAAGR 2020-2025.
 - The **display materials** market grew by almost 4% in 2021, performing much better than in recent years. The 2020-2025 growth outlook stands at 1.3% CAAGR. As in recent years, the gradual transition to OLED technology remains the most significant trend.
 - **PV materials** grew an outstanding 47% in 2021, driven by a combination of solid volume growth and higher materials prices. The flip side of this extreme growth is an essentially flat outlook over the subsequent several years as pricing normalizes, for an entirely front-loaded 2020-2025 growth outlook of 8% CAAGR.
 - The "**Other components**" segment includes materials for passives, connectors, and data storage components. Driven by strong systems demand, this materials segment grew 19% in 2021, reaching \$13.7Bn. The five-year outlook is for just under 5% CAAGR.
- Prismark's preliminary estimate for full-year 2021 electronic materials market growth stands at more than 32% over 2020. Half of this growth was due to battery and PV materials. For 2022, our current estimate calls for almost 10% year-over-year electronic materials market growth in total, but only 1.6% excluding battery and PV materials.

THE ELECTRONIC MATERIALS REPORTER

THIRD QUARTER • NOVEMBER 2021



- This issue of the *Electronic Materials Reporter* surveys the leading electronic materials suppliers.
- We profile the top 50 electronic materials suppliers by revenue during calendar year 2020. The electronic materials business of the largest supplier (Shin-Etsu) came close to \$5Bn by Prismark's definitions. In total, the top 50 suppliers generated some \$97Bn in electronic materials sales during the year.
- The battery materials segment stands out as a particularly fast-growing segment, and accordingly suppliers of related materials are increasingly to be found among the leading suppliers.
- Japanese-headquartered companies continue to dominate the list of leading electronic materials suppliers. However, their share has declined to 44% both by number and by revenue.
- The electronic materials market as a whole remains fragmented. The top 50 suppliers identified here represent some 60% of the total electronic materials market.
- In contrast, many individual market segments are highly concentrated. This applies especially to large segments with high customer concentration, where the need for access to financial and technology resources creates barriers to entry.
- The electronic materials forecast for 2021 has been revised upward to 25% growth over 2020. In contrast, the initial outlook for 2022 is for a slowdown to only 3% annual growth.



CONSULTANTS TO THE ELECTRONICS INDUSTRY
BUSINESS OPPORTUNITIES FROM TECHNOLOGY AND
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