

EMD Performance Materials Announces Comprehensive Materials Solutions for Chip Miniaturization and Smart Packaging

- **Smart materials solutions enable front- and back-end scaling**
- **Strong lithography portfolio supports advanced packaging of next-generation microprocessor, DRAM and NAND flash chips**
- **Investment in San Diego supports green manufacturing initiatives with development of eco-friendly interconnect materials**

Philadelphia PA, USA, July 10, 2017 – EMD Performance Materials, a leading science and technology company, today announced its portfolio of materials solutions for advanced semiconductor manufacturing. Mega-trends represented by big data, automotive electronics, IoT, and an increased interest in green assembly, is expanding the need for advanced semiconductor processing and novel materials solutions. With an innovative portfolio, EMD Performance Materials aims to enable the process of miniaturization supporting the continuance of Moore's law.

"Over the past three years, EMD Performance Materials has acquired AZ Electronic Materials, SAFC Hitech and Ormet Circuits, and has become a leading company developing and delivering IC materials solutions," stated Rico Wiedenbruch, head of Business Unit IC Materials, Performance Materials Business of Merck KGaA, Darmstadt, Germany. "We are one of the few companies in the world that is able to provide a comprehensive materials portfolio, broad expertise for materials solutions, and unmatched global support capabilities that customers know they can rely on."

Materials to Enable Further Scaling

The industry faces many scaling-related challenges, while silica still demands the highest quality and reliability with improved efficiency. EMD Performance Materials provides a wide variety of novel solutions to meet these emerging demands and solve miniaturization roadblocks that challenge the limits of physics. The company's advanced precursors for atomic-layer deposition are a turnkey solution for producing very thin, highly controlled conformal films. The company's Spinfil® spin-on dielectric material is designed to create narrow, insulating layers within transistors. Differentiated lithography materials include FIRM® rinse materials for improving photoresist pattern collapse for ArF and KrF lithography process and enabling EUV technology for future device manufacturing; KrF thick-film resists applied as hard masks enable production of 3D NAND staircases; and metal hard mask (MHM) offer superior properties of planarization, gap filling, etch selectivity and strip. These materials solutions play important roles in manufacturing future semiconductor nodes, as well as DRAM and NAND flash chips.

Materials Solutions for Smart Packaging

The continued advancement of smart phones, automotive, IoT and USB are demanding high density devices with smaller form factors. As a result, advanced packaging has become a key solution to further realize miniaturization in the back end, and solve system-level challenges. EMD Performance Materials offers key materials solution for lithography with its innovative liquid-type photoresist for >200µm thickness that achieves very steep patterned walls. In combination of other lithography materials, such as top antireflective coatings and rinses, EMD Performance Materials is able achieve the narrowest and most conformal feature lines for advanced packaging.

Going Green

Eliminating harmful materials from the supply chain is an important step to maintain corporate compliance. EMD Performance Materials offers eco-friendly interconnect and die attach materials to

replace lead-based solders, which meet RoHS and REACH compliance. These advanced materials are applied in power devices and expected to serve new memory devices, DRAM, 2D and 3D flash devices.

To fulfil the growing demand for green materials, EMD Performance Materials has invested in a new application lab in San Diego. The facility will provide a best-in-class R&D and analytical environment to support semiconductor application research, optimize the production process, and ensure on-time delivery. The application lab will help power and memory device customers quickly adapt to green materials for their manufacture process.

About EMD Performance Materials

EMD Performance Materials is the North America high-tech materials business of Merck KGaA, Darmstadt, Germany, comprising a portfolio of applications in fields such as consumer electronics, semiconductors, lighting, coatings, printing technology, plastics, and cosmetics.

Key products include display materials, LED materials for lighting as well as OLED materials for lighting and displays, functional materials for solar panels and energy solutions, effect pigments as well as active ingredients and fillers for cosmetics, food and pharmaceutical products, effect pigments and functional materials for coatings, printing and plastics and high-purity specialty chemical materials for the electronics and semiconductor industry. Today, the business has about 500 employees around the country with main operations in Philadelphia (PA). For more information, please visit www.emd-pm.com.

About Merck KGaA, Darmstadt, Germany

Merck KGaA, Darmstadt, Germany, is a leading science and technology company in healthcare, life science and performance materials. Around 50,000 employees work to further develop technologies that improve and enhance life – from biopharmaceutical therapies to treat cancer or multiple sclerosis, cutting-edge systems for scientific research and production, to liquid crystals for smartphones and LCD televisions. In 2016, Merck KGaA, Darmstadt, Germany, generated sales of € 15.0 billion in 66 countries.

Founded in 1668, Merck KGaA, Darmstadt, Germany, is the world's oldest pharmaceutical and chemical company. The founding family remains the majority owner of the publicly listed corporate group. Merck KGaA, Darmstadt, Germany, holds the global rights to the „Merck” name and brand. The only exceptions are the United States and Canada, where the company operates as EMD Serono, MilliporeSigma and EMD Performance Materials.