Driving development through an expanded “global-local” organization

The key to application-tailored coating materials

Sulzer Metco produces coating materials with clear customer benefits thanks to state-of-the-art facilities, globally coordinated teams, and superior manufacturing capabilities. Customers profit from many application-tailored new materials and solutions.

New and emerging markets are increasing the need for cutting-edge, engineered coating solutions. At the same time, the challenge in existing markets is to lower coating application costs, innovatively reuse and recycle materials, address and find suitable alternatives for critical raw materials, and, in particular, to have more predictable and robust coatings. “Designed to cost and purpose” (application and service conditions) coating solutions should start with the choice of the most suitable coating material. This method requires an in-depth approach that examines: how material characteristics and coating properties are influenced by the choice of materials manufacturing processes and parameters; the subtleties of choosing one raw material instead of another; and material charac-

The pilot atomizer allows Sulzer to efficiently provide experimental powders in quantities of 5 to 100 kg.
teristics such as apparent density, surface area, particle morphology and structure, and other key physical properties. Such factors must be considered to a far greater degree than in the past, where coating engineers would traditionally just focus on selecting a material based on chemistry and particle size distribution and modify coating characteristics by varying the spray equipment and parameters.

Expanded material research and development capabilities

Sulzer Metco’s Materials Business Unit provides powder, wire, and specialty rod materials for coating applications such as thermal spray, laser cladding, and plasma-transferred arc (PTA), as well as for processes such as high-temperature brazing, pack diffusion, specialty welding, and electronic filler applications. The products offered range from many types of oxide ceramics, carbides, cermets, metals, and metal alloys—including superalloys, MCrAlYs, self-fluxing materials, and various blends or clad combinations of these materials.

Sulzer Metco’s mission is not only to continue to lead this particular market with lean, high-volume material manufacturing using in-place, state-of-the-art quality systems, but also to address the need for faster, more efficient, and higher-impact innovation based on cutting-edge product development. This includes fast availability of test powders for sampling purposes, assurance of efficient prototype-to-production transfer and scale-up capability, and responsiveness to the customers’ needs based on expert knowledge of how to tailor coating materials to achieve specific coating performance and application demands.

A specialized infrastructure is needed that allows the rapid manufacture of small batches of materials with full flexibility to widely vary material processing parameters, manufacturing technologies, and chosen raw materials. It also requires the ability to test the resulting material and coating characteristics, properties, and performance quickly.

Consequently, Sulzer Metco has strengthened and expanded its materials research and development (R&D) capabilities over the last several years.

Powder development and pilot labs

R&D powder development laboratories were established at each of the four material manufacturing sites, and they were equipped with the latest processing equipment and cutting-edge characterization technologies. Each powder development laboratory has specialized core competencies that, at minimum, mirror the manufacturing methods available at that particular plant.

- Troy, MI, USA: The powder laboratory at the Troy plant specializes in gas atomization, including a newly installed pilot atomizer. Screening, air classification, and blending capabilities are currently in the works. Based on these, the lab will be able to efficiently provide experimental powders in quantities up to several hundred kilograms—completely independently of the production facilities.
- Barchfeld, Germany (WOKA): The WOKA powder laboratory, which started up in 2009, has a small spray dryer, a tablet press, several furnaces, crushing equipment with hard metal tools, and an air classifier combined with a jet mill. The lab can produce agglomerated and sintered ceramics and carbides as well as sintered and crushed carbides as test powders.
- Fort Saskatchewan AB, Canada (SMCA): At the SMCA development
laboratory, a large variety of powders are chemically clad using hydrometallurgy technology. The volumes produced are suitable for thermal-spray testing and developmental lots using a laboratory-sized pilot autoclave. This facility also has the capability to resize, dry, and furnace-heat-treat powders in different atmospheres, thereby fully reproducing the capabilities of the actual production facilities. In this manner, new materials can be developed in fully scalable conditions. The materials R&D lab also features scale-up development and commercial production of high-quality, gold-coated nickel-based composite powders using a proprietary process. These materials are primarily used for electronic and military applications.

Coating research labs

Beside the powder development labs, the coating research laboratories are an important part of Sulzer Metco’s materials R&D capabilities. The focus of these labs is to enable initial, fast, in-house testing of coatings produced using the experimental powders—an essential step in screening promising material candidates. In this way, correlations can be drawn quickly between material characteristics and coating properties.

The engineers can then optimize the materials manufacturing processes and the manufacturing parameters to tailor materials to specific application and service conditions. The available equipment includes salt spray, climate chambers, and electrochemical equipment for corrosion testing, various wear testers, and thermal-cycle furnaces. A burner rig and a cavitation wear tester were recently added.

For final validation and testing of coating properties beyond the in-house capabilities, Sulzer Metco calls on an extensive partner network of respected research and testing facilities that extend its coating testing capabilities even further. As an example, Sulzer Metco Materials, through its cooperation with Sulzer Innotec in Winterthur, Switzerland, has a cutting-edge abradable test rig at its disposal. The rig is a vital tool for Sulzer Metco and its OEM aerospace and industrial gas turbine partners for joint abradable development programs.

The facility is the largest and most sophisticated of its kind—with the ability to test shroud temperatures up to 1200°C using a variety of blade, knife-edge seal, or labyrinth seal strip configurations at a wide range of tip speeds and incursion rates. A recently installed high-speed infrared pyrometer provides additional vital risk-mitigation information on friction heating arising at shroud-blade interfaces during incursion.

The advantages of a “global-local” approach

Since each powder development laboratory is located at its relevant manufacturing site, R&D, production, and quality control can exchange know-how efficiently; they can optimize the use of the analytical instrumentation; and they can piggyback on the logistics infrastructure of the plant. Time to market is minimized through the effective and timely introduction of successfully validated development products into large-scale manufacturing.

For example, the installation and operation at Sulzer Metco WOKA of a new sintered- and crushed-carbide production line, based on process development by the local R&D group has resulted in a wide range of new and more economical products within a very short time—demonstrating the success of this concept.
Nevertheless, a global approach is needed, as well. Good examples are agglomerated and sintered lanthanum strontium manganite (LSM) and spherical titanium oxide (TiOx) ceramic products, which took advantage of the development expertise of the Westbury materials R&D team, but are manufactured at Sulzer Metco WOKA in a newly established facility.

A global approach not only allows optimal resource usage, knowledge exchange, and utilization of expertise, it also guarantees that the best coating—and, therefore, the best product solution—is offered to the customer. This is particularly important as powders with the same chemistry can be manufactured at the various sites using different manufacturing processes resulting in quite different coating properties. It is therefore important to select the manufacturing process independently of the plant or the location of the R&D lab and instead base it solely on the application and service requirements.

Globally operating materials R&D project managers and competence leaders who drive and coordinate all research activities and who use the various local powder and coating research labs for their experimental work maintain the balance between the local and global approaches. The projects are managed based on Sulzer’s systematic multistage innovation process and are carried out with the support of cross-functional and multiregional project teams.

**Customer benefits**

A globally coordinated team that has state-of-the-art facilities at its disposal, combined with local mirroring of manufacturing capabilities, and internal and external networking allows Sulzer Metco to produce coating materials with clear customer benefits. In the past year alone, a record number of test powders were produced for customers, and many application-tailored new materials were developed and released to the market. Notably, several of these developments did not involve the need for new coating chemistries. Some of those examples include:

- New spherical titania powders (TiOx) with various x-factors that permit the customer to produce coatings with higher-than-usual deposition efficiencies at very high feed rates, which are essential criteria for sputter target applications
- Spherical ceramics such as alumina and alumina-titania designed to produce coatings faster and with less material waste while fulfilling specific porosity requirements
- Cost-effective carbide materials for aerospace applications with excellent coating deposit efficiencies that do not sacrifice wear resistance.

Sulzer Metco is committed to leading the market with application-tailored and economical coating solutions that meet the needs of our customers.

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