Editorial

Problems with the Delivery of Materials Property Data

Manufacturing industries are undergoing sweeping reengineering efforts. Their efforts are directed toward manufacturing planes, cars, trucks, and commodities as quickly as possible, while radically transforming the way they design and manufacture them. The growing ability of the Original Equipment Manufacturers (OEMs) to compete has been through the use of concurrent engineering, which is a seamless environment for definition, design, and engineering of a product, and its supporting processes. These changes are taking place at a time when long-standing rivals are conspiring to keep profit margins down. OEMs are increasingly using computer simulations to design these products more efficiently, and they are striving to bring their parts suppliers along with them.

The goal of this reengineering work isn't just cost reduction. The OEMs want to dramatically cut the time that elapses between order and delivery. The main benefit of reducing the time between order and delivery for the OEMs having this capability is lower carrying costs. Shorter lead times also benefit the customer by letting him specify orders closer to the time he needs to purchase a car, truck, plane, or commodity item. Shorter lead times make manufactured products more affordable and sustainable, which is a big plus for the economy in a fast-changing business.

A fundamental problem exists with the delivery of materials property data, which is needed for the concurrent engineering process. The simultaneous enterprise process demands that part suppliers use predictive analysis to visualize the behavior of metal-forming processes in three-dimensional view, within hours. Process verification must be done, without having ever created an actual prototype part. I would like to discuss several problems of delivering and marketing material information associated with process simulation of such processes as near netshape forging and metal casting. In particular, I want to emphasize the importance of overcoming economic obstacles to the generation and delivery of materials property data to the metal-forming community. Historically, the material producers have generated and distributed material information as part of their product marketing program.

The kinds of material data needed by the metal-forming community for simulation-based design are comprehensive thermophysical properties, constitutive models for linear and nonlinear behavior, and knowledge about microstructure-property-processing relationships for the important engineering alloys. In addition, similar materials property data for die materials also must be generated and distributed. Without these important material properties, the small- to medium-size part suppliers will not be able to compete in the concurrent engineering process.

The information industry, such as ASM International, has made a wide-ranging effort to provide computerized materials property data to users, primarily for product design and, to a lesser extent, for process design. However, these attempts have not always given users adequate answers to their problems. The problem of delivering product and process design data electronically for material selection is more complex than delivering a material database for process simulation. For example, material selection guides for a structural application require excessive knowledge on the part of product and process designers. A lack of discrimination among the different needs of designers is common in most commercial databases, and most electronic databases generally have insufficient data to properly screen material choices. The specificity, format, and quantity of data needed depend upon how the product or process designer plans to use these data.

Inherent with these generic problems of commercial databases is the insufficiency of the data. Information vendors, like ASM International, need to continuously create new data sets and process their existing data to make their products answer questions their users are asking. Product and process design engineers want answers to critical problems such as selecting a cost-effective die material, which can stand the rigors of producing 10,000 parts a day by hot forging. Information for predicting die life, which includes data on fracture toughness and low cycle fatigue behavior, is very important for the process engineer. For the materials property data industry to become more useful to its users, it needs to base its efforts on the presumption that designers want answers to problems. Providing access to existing tables of printed data, such as the mechanical properties of engineering alloys, generally satisfies only a limited number of designers.

The primary source of revenue for most information providers in the materials property industry is the income earned from selling software and data. This needs to change so a significant amount of income can be earned from the producers of material and from the users. Producers should be convinced to view materials property data as marketing tools. Since this marketing view is how the creation and distribution of materials property data have been funded historically, it may be the only way the information industry will gain sufficient funding to create viable products. Users of materials property data should also share in the cost of generating and distributing materials property data that are specific to the needs of computer simulation.

Today, most companies that include process simulation as part of their company's product realization process usually pay some outside organization to generate materials properties for the workpiece and tooling materials, which they use in manufacturing. Think of how many times this process is repeated by the users of material information for process simulation. When materials property information is generated with company funds, it almost always becomes proprietary information. Would it not be less expensive if all users would share in the cost of creating and delivering good materials databases? The current financing methods used by the information industry apparently do not allow this to happen.

The computerization of materials property data is essential for OEMs and their parts suppliers to compete in the world marketplace (Ref 1). For the computerization process to proceed, it appears that it will be necessary for producers and users to be more firmly involved in bearing the costs of producing and distributing material data. Standard formats should be used to allow the data to be combined easily with other data sets. ASM International's Phase Diagram Program in the 1980s demonstrated how the manufacturing industry, academia, and producers can collaborate to generate and deliver phase diagram information. It is an opportunistic time for our society to take the lead again in delivering materials information that supports the needs of product and process designers by creating a materials product and processing information project. This type of project has the potential for being a financial success, while helping the manufacturing enterprises to be competitive in the global market.

Reference

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