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Editorial

Editorial on Smart Materials

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SMART MATERIALS

Smart structures, also known as smart materials systems, are those that include highly integrated actuators and sensors with structural functionality, as well as highly integrated control logic, signal conditioning, and signal power amplification electronics. It is expected that the technology under development, in both its present and evolutionary forms, will be widely used in the coming decades. This technology's range of applications is projected to extend not only to high-tech but also to civilian fields. The demand for new generations of industrial, military, commercial, medical, automotive, and aerospace products has fueled R&D efforts in advanced materials and smart structures. Humankind's scientific interest in synthesizing new classes of bio-mimetic materials has exacerbated the situation. Global rivalry among the major industrial nations has, of course, been a factor in determining the rate of technological advancement. The ultimate materials, according to a basic axiom in this field of advanced materials, are biological materials that reproduce certain characteristics and properties in synthetic materials and can be used in a variety of scientific and technical applications. Thus, by combining the knowledge bases associated with advanced materials, information technology, and biotechnology, the development of a new generation of biomimetic materials and structures with built-in brains, nervous systems, and actuation systems can be encouraged. In comparison to the anatomy that will be viewed in the not-too-distant future, this is just a skeleton. Materials innovations have had such a profound impact on human civilization that historians have identified time periods based on the materials that dominated at the time. As a result of humanity's never-ending search for better goods and weapons made of better materials, words like Stone Age, Bronze Age, and Iron Age have become part of the lexicon.

The current Synthetic Materials Age, which includes plastics and fibrous composites, is serving as a viable precursor to the dawn of a new century, the Smart Materials Age, which will use these synthetic materials to harness a variety of emerging technologies to create smart materials with nervous systems, minds, and muscular capabilities. The level of complexity exhibited by this new generation of materials will largely depend on the applications; however, numerous developments in diverse fields of research, such as nanotechnology, biomimetics, neural networking, artificial intelligence, materials science, and molecular electronics, are expected to emerge. The effect of this new generation of smart materials on civilization will be huge. Some materials, for example, will be able to pick and perform specific functions autonomously in response to evolving environmental stimuli, while others will only have embedded sensory capabilities to ensure that a structural member meets quality control requirements. Smart structures, also known as smart materials systems, are those that include highly integrated actuators and sensors with structural functionality, as well as highly integrated control logic, signal conditioning, and signal power amplification electronics. Such actuating, sensing, and regulating are built into a system to influence its states or properties, whether mechanical, thermal, optical, chemical, electrical, or magnetic. The theoretical viability of smart structures has been established by a combination of three historical trends. The first is a shift from unlaminated materials to laminated materials. Structures were previously made from large pieces of monolithic materials that were machined, forged, or moulded into a final structural shape, rendering the inclusion of active elements difficult to imagine.

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