MANUFACTURING . . . THE FUTURE
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Continued progress in many fields of engineering depends upon our capability to manufacture components and devices with required geometry and material characteristics, and from materials demanded by specific applications. Thus, true, revolutionary progress requires the development of technologies for producing and processing new kinds of materials, achieving qualities or precision unattainable before, and optimizing those technologies to enable their dissemination to society. This Manufacturing… The Future symposium focuses on two fields where novel manufacturing technologies are expected to enhance our living standards in the near future: the manufacturing of medical devices and energy systems.

Manufacturing for medical devices for in vivo and in vitro applications
Fabrication of medical devices from bio-compatible materials poses multitude of challenges. Many of such devices are required to have micro- or meso-scale, high precision features, and to be fabricated from bio-absorbable (e.g., poly(lactic acid)) or inert (e.g., titanium alloys or stainless steel) materials. A further challenge that is preventing future discoveries is the need for understanding both the biological/physiological characteristics of human body as well as the emerging fabrication technologies for multi-scale manufacturing of implantable medical devices. The emphasis in this section will be given to particular manufacturing techniques for fabricating multi-scale implantable devices from a broad range of materials, considering their geometric and material capabilities.

Our first speaker in the session, Wei Li (University of Texas at Austin) will review the current challenges in biomedical manufacturing, focusing on applications in areas like micro-fluidic devices, tissue scaffolds and tissue model systems, as well as surgical tools and drug delivery devices. Next, he will present in detail a cutting-edge implementation of a 3D tissue model system for personalized cancer chemotherapy.

A key challenge involved in developing active medical implants is ensuring that the implanted device maintains its functionality in the long term under interaction with the harsh conditions inside the human body.Thomas Velten (Fraunhofer IBMT) will introduce the concept of biocompatibility and discuss the state-of-the-art technologies and the existing standards to ensure that a medical device meets these utmost requirements. Particular attention will be given to applications where the classical rigid metal housings are inappropriate due to, e.g., mechanical requirements (bending) or communication needs.

Manufacturing Energy---Manufacturing Technology for Next-Generation Energy Systems

This session will concentrate on the characterization of sustainable technologies to satisfy our energy needs, and the manufacturing challenges involved in the implementation of such technologies. In particular, we will concentrate on solar energy and second-generation bio-fuels, and the technologies required to manufacture the systems to produce, store, and transmit energy.

It is widely agreed that solar energy will play a key role in covering the energy needs of humanity in the close future. However, the large-scale and efficient exploitation of solar irradiation poses a multitude of challenges on manufacturing technologies. Michael Filler (Georgia Institute of Technology) will present the underlying physical mechanisms, as well as the recent advances in materials science and fabrication technologies to achieve these ambitious goals.

In applications where electricity is not a viable power source, e.g., in different branches of transportation, biofuels are a promising means to achieve carbon-neutrality. The final presentation in the session by Jarno Kuijvenhoven (DSM) will overview the state-of-the-art technologies to convert lignocellulosic biomass to fuels in a sustainable, cost-efficient way, without conflicting the human food chain. An outlook to the major consequences on logistics, finance, and legislation will also be given.