In Brief

■ Materials research has developed by leaps and bounds over the past 20 years. Up until now, the focus has been on optimizing and customizing known materials. In the future, the emphasis will be on developing smart materials. (p. 9)

■ Future developments will require an even greater amount of interdisciplinary work. Researchers from widely different fields will not only have to cooperate, they will also have to incorporate users in the process at an early stage. In addition, all the parts of a component will have to fit together perfectly. (p. 9)

■ Nanotechnology is of key importance. By integrating tiny particles, it becomes possible to give materials completely new properties. The long-term goal is to produce miniature components one atom at a time. However, most experts believe it is very unlikely that there will ever be self-producing nanorobots. (p.18, 23)

■ Nanotechnolgy and biotechnology — the tools of technology and nature — are being combined to create a new unity. One of the first successful results of this symbiosis is the growth of nerve cells on silicon chips. By imitating naturally grown structures, scientists can create particularly light and stable components. (p.15)

■ Adaptronics helps with the creation of materials that adapt to their surroundings. Here, sensors, controls and actuators are combined in tiny areas. Siemens, for example, uses a memory metal to control a valve in a dishwasher. (p. 12)

■ Combinatorial chemistry and automated mixing and analysis systems help scientists find new materials by enabling them to evaluate substances up to 100 times faster. (p. 26)

■ Faster computers allow researchers to fully simulate materials. In the future, this will enable them to forecast not only a substance's mechanical properties, but also its optical, magnetic and electrical ones. This multiscale modeling combines quantum effects with the interaction of atomic clusters and the finite elements method. (p. 26)

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LINKS

Adaptronics pilot project:
www.lp-adaptronik.de
Max Planck Institute of Biochemistry, Prof. Peter Fromherz:
www.biochem.mpg.de/mnphys
Nanotechnology at the VDI:
www.nanonet.de/indexe.php3
Online magazine for nanotechnology: www.smalltimes.com
Prof. Richard Smalley's homepage:
www.ruf.rice.edu/~smalleyg
Prof Harry Kroto's homepage:
www.cpes.sussex.ac.uk/chemistry/staff/hwk.html
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