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All that matters

As we celebrate our fifth anniversary, we remain committed to excellence in materials science. High-temperature superconductivity is our focus this month.

Five years ago we were already convinced that materials science was a natural editorial choice for Nature Publishing Group's first venture in the physical sciences[1]. Judging by our latest impact factor of 19.194 for 2006 we seem to have been proved right.

Beyond this bibliometric indicator[2], we fully recognize that we owe our success to the ongoing support and encouragement of the materials community, and we are especially indebted to all authors and referees that have been involved in the journal since launch.

To mark our fifth anniversary this month, we have compiled a collection on our website of landmark articles published since 2002, illustrating the breadth and interdisciplinary nature of the field and its impact on future advances in information technology, energy production and bio/nanotechnology.

What will the next five years bring? For materials research it is difficult to predict what's around the corner, but it seems clear that we will see even more integration of other disciplines such as computing, biology and medicine. Nano/biomaterials, self-assembly and smart materials will continue to represent some of the fastest-growing areas. In condensed-matter physics, current trends suggest that much progress will be made in the areas of spintronics, correlated electron systems and carbon electronics. With acceleration in the exploration of novel materials and phenomena we should also experience increased activity in the area of improved synthesis, advanced analytical techniques and materials theory and modelling. Finally, materials that improve our management of the environment, natural resources and recycling will become more prominent.

Wherever materials research takes us, we will continue to evolve and maintain our editorial independence and high standards. We are more than ever committed to publish not only the most influential and intellectually stimulating multidisciplinary research, but also to provide a lively forum in which scientists from very different backgrounds can come together and exchange ideas. Our ultimate goal is to serve the community and provide a vehicle to reflect the increasing importance of materials for ensuring economic growth and improving our standard of living within a framework of sustainable development.

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Electron microscopy image of a 150-nm-thick $YBa_2Cu_3O_{7-\delta}$ film showing high-density twin-planes (image width ~1.5 μm).

Part of our fifth anniversary issue focuses on a research area with a rather longer history —that of copper-oxide perovskites (cuprates), in which high-temperature superconductivity was discovered in 1986. It is easy to imagine the excitement in the few months following the discovery, which we revisit in our interviews with Georg Bednorz[3], and Paul Ching-Wu Chu[4]. More than twenty years on however, the transition temperature from the normal to the superconducting state is still around 100 K, and the general consensus on the origin of the phenomenon is that there isn't a general consensus. Nevertheless, from an application point of view, the challenge is not to understand the mechanism behind the lossless current flow, but to increase the amount of current that can flow without dissipation.

Rather ironically, improved performance of cuprates requires less- rather than more-perfect materials. This aspect is highlighted by Steve Foltyn and co-authors, who in their comprehensive review guide us through the numerous types of defects that materials scientists have introduced in cuprates to block the drift of magnetic vortices, which is the main origin of dissipation[5]. These research efforts, followed by industrial processing, have opened the door to commercialization. Indeed, several prototypes of high-temperature superconductor applications have already been realized, as highlighted by Alexis Malozemoff in his commentary[6]. Whether or not these materials are the best candidates for reducing energy consumption and the effects on environment is still debatable, but they can certainly play a role.

Regardless of the current status of applications, the simple concept that by cooling a material its resistivity vanishes is fascinating, not just for specialists. We won't hold our breath waiting for a room-temperature superconductor, but we'll keep following with interest all efforts to improve the performance, whether that means further reduced dissipation or increased transition temperature.

References
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