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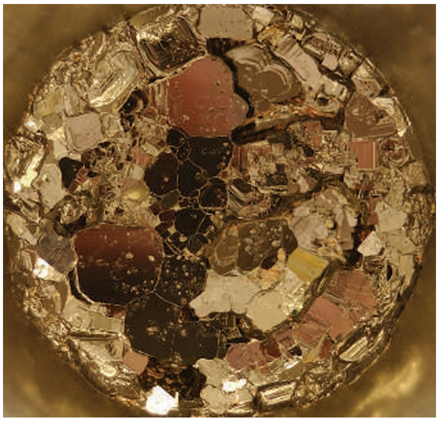
The best is yet to come

As the leading physical sciences journal, *Nature Materials* remains devoted to new developments in exciting research areas such as multiferroics.

Five years on and still safely away from the seven-year itch, let us reflect at the beginning of the calendar year on recent developments in our journal. Our first and foremost principle is still to uncompromisingly publish the most significant and influential articles in all areas of materials science. We have done so successfully in the past — as evinced by standards that have put us at the top of all physical sciences journals since 2004 — and we will continue to do so in future. We do of course fully appreciate that our success depends on the support from authors who choose us for publishing some of their best work, as well as the help from our invaluable referees, who, despite an increasing workload, continue to deliver detailed and thorough reviews.

Nevertheless, in a competitive environment that continually sees the launch of new journals, we cannot rest on our laurels and are more than ever committed to providing you with a modern, lively journal that reflects the dynamics of the field. This is not only reflected in our new design, but also by exciting new features such as interviews. Furthermore, as we have done increasingly over the past year, we will continue to occasionally devote a larger section of an issue to a specific topic — be it a science policy issue, or an in-depth focus on a particularly hot field.

This month we take a close look at multiferroics. Multiferroics are materials that show both ferromagnetism and ferroelectricity at the same time. A coupling of electric and magnetic fields in materials was speculated on as early as 1894 by Pierre Curie[1]. However, multiferroics are rather rare 'creatures', as it is difficult to combine ferroelectricity and ferromagnetism in the same material. The problem is mainly due to mutually exclusive requirements on the electronic occupation of the outer atomic shells in common transition metal oxide ferroelectrics and ferromagnets. It was only in 1959 that magnetoelectric coupling in Cr_2O_3 was predicted by Dzyaloshinskii[2] and observed by Astrov a year later[3]. This coupling was so weak that the initial excitement quickly declined.



SOONYONG PARK AND SANG-WOOK CHEONG

Conglomerated single crystals of the multiferroic $TbMn_2O_5$ as obtained from high-temperature solution growth. The largest crystal is ~2 cm wide.

As Sang-Wook Cheong and Maxim Mostovoy point out in their review[4], the field has recently seen a significant revival. This renaissance is based on the discovery of compounds that show a much stronger multiferroic coupling. The physics of these compounds is rather different from common magnetoelectrics, and incites the exploration of a wide range of possible material systems, driven by potential applications such as electronic devices or sensors. This requires the capability to grow thin films, and in their review, Ramamoorthy Ramesh and Nicola Spaldin discuss the recent progress and prospects in thin-film multiferroics[5].

The remarkable properties of ferroelectric thin films are exemplified by the work of Chun-Lin Jia and co-workers[6], which looks at such films on an atomic scale. The importance of this microscopic study is emphasized by the News & Views by Paul Muralt, who, based on these findings, is able to expand our understanding of the coupling of crystal structure and ferroelectricity in thin films[7].

Because of such exciting discoveries, the entire field is currently experiencing a surge of activity. This is exemplified, for example, by the large number of sessions at recent Materials Research Society as well as American Physical Society meetings, and the excitement that transpires from more focused events, such as the Orbital 2006 workshop on physical phenomena in transition metal oxides that was held in Berlin.

There is still much progress to be made towards an improved understanding of the fundamentals governing multiferroics, as well as in the fabrication of thin films. As more and more researchers enter this field, we hope that the overview presented in this issue serves as a useful guideline to these fascinating materials.

References

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