

## What to Look for in New Superconductors if We Want to Make Them Useful

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***Abstract***—Discoveries of new superconductors and advances in R&D of high-T<sub>c</sub> cuprates and Fe-based pnictides have shown that such captivating characteristics as high critical temperature and upper critical magnetic field are not enough to assure applications at high magnetic fields and temperatures. Making superconductors useful involves complex and expensive technologies addressing many conflicting physics and materials requirements which are not only specific for a particular application but can also change, depending on the operating field and temperature. In this talk I discuss the materials properties which would be highly desirable in new practical superconductors, and the ways by which the performance of existing superconductors can be enhanced by tuning the materials properties and by nano structuring. As representative examples, I consider the physics and materials science behind the optimization of superconductors used in high dc field magnets and high-Q resonators for particle accelerators or quantum circuits. These applications have different parameters of merit and require very different ways of enhancing the material performance. Eventually, the most practical superconductors may not have the best superconducting properties but provide the best compromise between physics, materials science, technology, environmental impact, and cost.

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