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Compositional Studies of Metals with Complex Order by means of the Optical Floating-Zone Technique

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The availability of large high-quality single crystals is an important rerequisite for many studies in solid-state research. The optical floating-zone technique is an elegant method to grow such crystals, offering potential to prepare samples that may be hardly accessible with other techniques. As elaborated in this presentation, examples include single crystals with intentional compositional gradients, deliberate off-stoichiometry, or complex metallurgy. For the cubic chiral magnets Mn1−xFexSi and Fe1−xCoxSi, single crystals are prepared in which the composition is varied during growth from x = 0 to 0.15 and from x = 0.1 to 0.3, respectively. Such samples allow us to efficiently study the evolution of the magnetic properties as a function of composition, as demonstrated by means of neutron scattering. For the archetypical chiral magnet MnSi and the itinerant antiferromagnet CrB2, single crystals with varying initial manganese (0.99–1.04) and boron (1.95–2.1) content are grown. Measurements of the low-temperature properties address the correlation between magnetic transition temperature and sample quality. Furthermore, single crystals of the diborides ErB2, MnB2, and VB2 are prepared. In addition to high vapor pressures, these materials suffer from peritectic formation, potential decomposition, and high melting temperature, respectively.

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