

Nanoscale flux pinning sites in high-Tc superconductors

M. R. Koblishka, M. Winter, A. Hu, M. Muralidhar, U. Hartmann, M. Murakami

Ideal flux pinning centres in high-Tc superconductors should be of nanometre size as the coherence length, is so small. Therefore, the optimisation of high-Tc superconductor samples concerning high critical current densities and high flux pinning has to take place in the nanometre range. An important goal of the current research is to find specific preparation strategies to create such ideal flux pinning sites already during the sample processing. By means of AFM and STM measurements at ambient conditions, we have investigated the topographies of various samples of YBa₂Cu₃O_x (YBCO), NdBa₂Cu₃O_x (NdBCO), SmBa₂Cu₃O_x (SmBCO), (Sm,Eu,Gd)Ba₂Cu₃O_x (SEG) and (Nd,Eu,Gd)Ba₂Cu₃O_x (NEG) high-Tc superconductors. We find that the two systems with the highest critical current densities (NEG, SEG) and hence, the strongest flux pinning, exhibit microstructures on the nanometre scale which are remarkably different from those obtained in the YBCO system. The stripe-like growth structures observed in our topography measurements may be the key for the considerable improvements concerning the critical current densities especially at high magnetic fields and elevated operating temperature (77 K).