

Special pinning phenomena in superconductors with regular composite  
pinning arrays

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Abstract

Superconducting films with composite pinning sites are made with electron-beam lithography and reaction dry etching techniques. The composite pinning array consists of large pinning sites and small pinning sites. The large pinning sites are positioned on a honeycomb grid and the small pinning sites are positioned at the center of every hexagonal cell formed by the large pinning sites. Magnetotransport measurements are carried out by a four-probe technique. Special critical currents matching peaks are observed for this film at different temperatures. The positions and structures of the matching peaks seem irregular and are very different from the structures of the matching peaks for previously explored films, such as films with triangular, square, or honeycomb pinning arrays. By considering the multiple-vortex filling of different pinning sites, we could give a reasonable explanation to this interesting phenomenon.

Keyword : Superconducting films, composite pinning array, matching peaks, electron-beam lithography