Coexistence of ferromagnetism and superconductivity of nanostructured single-phase Bi_3Ni

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Here we demonstrate the unique coexistence of superconductivity and ferromagnetism in single-phase Bi_3Ni nanostructures. For the production of the structurally confined intermetallic compound, we have developed novel chemical-reaction paths. Under variation of preparation parameters, nanostructures in several aspect ratios have been manufactured. We have characterized their magnetic and superconducting properties by means of magnetometry and electrical-transport measurements. Other than in bulk geometry, submicron-sized particles, spherical nanoclusters, and quasi one-dimensional nanoscaled strains of single-phase Bi_3Ni undergo ferromagnetic order. Superconductivity in nanostructured Bi_3Ni emerges in the ferromagnetically ordered phase and is stable up to remarkably high magnetic fields. Uniquely, superconducting and ferromagnetic material properties evidently complement each other in structurally confined Bi_3Ni. Both, Ferromagnetic hysteresis and zero resistance is observed. The coexistence of superconductivity with ferromagnetic order in Bi_3Ni nanostructures would most likely be possible in the case of triplet pairing. [1]

[1]T. Herrmannsdöerfer et al, Phys. Rev. B **83**, 140501(R) (2011).