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Enhanced Superconductivity in Aluminum-based Metamaterials[1]

CHRISTOPHER JENSEN, WILLIAM ZIMMERMAN, Towson University, JOSEPH PRESTIGIACOMO, M.S. OSOFSKY, HEUNGSOO KIM, NABIL BASSIM, Naval Research Laboratory, ZHEN XING, M. M. QAZILBASH, College of William and Mary, IGOR SMOLYANINOV, University of Maryland, VERA SMOLYANINOVA , Towson University — Recent experiments have shown the viability of the metamaterial approach to dielectric response engineering for enhancing the transition temperature, Tc, of a superconductor. We demonstrate the use of Al2O3-coated aluminium nanoparticles to form the recently proposed epsilon near zero (ENZ) core-shell metamaterial superconductor with a Tc that is three times that of pure aluminium [1]. We have also demonstrated that an Al/Al2O3 hyperbolic metamaterial geometry is capable of a similar Tc enhancement, while having superior transport and magnetic properties compared to the core-shell metamaterial superconductors [2]. These results open up numerous new possibilities of considerable Tc increase in other simple superconductors. [1]. V.N. Smolyaninova, K. Zander, T. Gresock, C. Jensen, J.C. Prestigiacomo, M.S. Osofsky, and I.I. Smolyaninov, Scientific Reports 5, 15777 (2015). [2]. V.N. Smolyaninova, C. Jensen, W. Zimmerman, J.C. Prestigiacomo, M.S. Osofsky, H. Kim, N. Bassim, Z. Xing, M.M. Qazilbash, and I.I. Smolyaninov, Scientific Reports (in press), (2016).

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