Superconducting properties of aligned flexible networks and yarns of MgB$_2$-CNT nanowires$^1$ JULIA BYKOVA, MÁRCIO DIAS LIMA, DERRICK TOLLY, CARTER HAINES, AUSTIN HOWARD, MYRON SALAMON, RAY BAUGHMAN, ANVAR ZAKHIDOV, University of Texas at Dallas

Magnesium diboride (MgB$_2$) has attracted great interest due to its outstanding superconducting characteristics. Literature reports showed that addition of carbon nanotubes (CNT) to a MgB$_2$ matrix significantly improves its properties: CNTs can carry extremely high currents and also provide electrical and mechanical connection between MgB$_2$ grains. Here we present a new method to produce networks of aligned MgB$_2$-CNT nanowires which can be spinned into flexible yarns. Freestanding, aligned CNT sheets were used as a starting network. A conformal layer of boron was deposited on CNTs by Laser Assisted Chemical Vapor Deposition. The resultant boron-CNT nanowires (thickness of 70±10 nm) were exposed to magnesium vapor and were converted into MgB$_2$-CNT composites. The MgB$_2$-CNT arrays are flexible and can be easily bent and even twisted. Critical temperature reaches 37 K and depends on thickness and crystalline structure of nanowires. Critical current and critical fields were shown to be comparable or even better than standard MgB$_2$ wires. We discuss the correlation of observed two step behavior in electric transport curves with interconnects between MgB$_2$-CNT nanowires and Josephson junction network formation.

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