

# Development of Bi-2212 high temperature superconducting magnet

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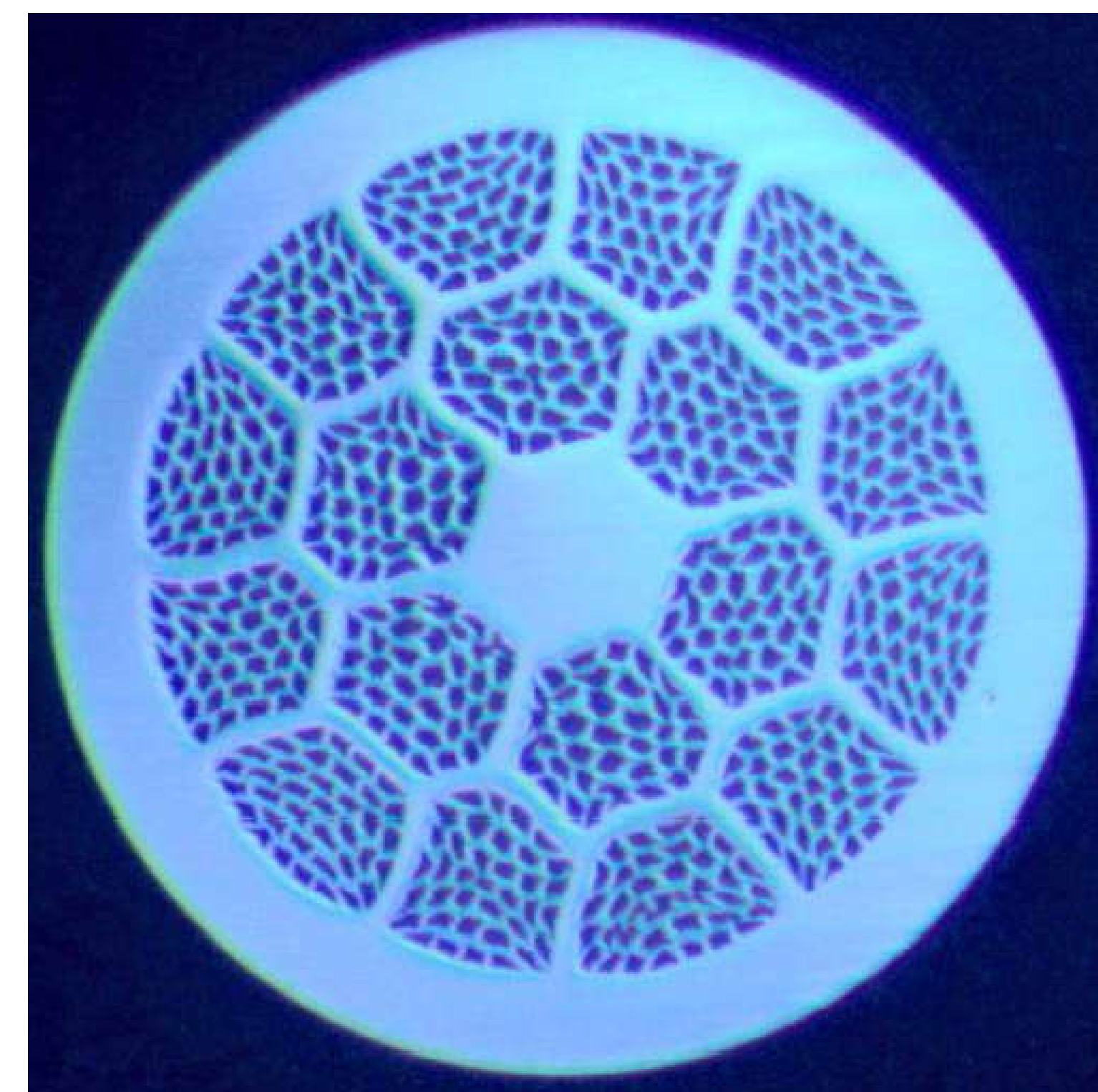


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## Introduction

Abstract—High temperature superconductor Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+δ</sub> (Bi-2212) exhibits high irreversibility field H<sub>c2</sub> of nearly 100 T, and high critical current density under high field with the J<sub>c</sub> of over 6800 A/mm<sup>2</sup> under 4.2 K, 15 T. Therefore, it shows great potential in the fabrication of low temperature, high field magnet. In our institute, Bi-2212 multifilamentary round wires with length over 200 m have been successfully prepared. With our optimized high pressure sintering technique, the current capacity of obtained wires has been obviously improved. The maximum engineering critical current density of 1300 A/mm<sup>2</sup> has been obtained under 4.2 K, 5 T and over 800A/mm<sup>2</sup> at 12T. With these wires, we have developed a Bi-2212 high temperature superconducting magnet through the winding and reacting method. The magnet inner diameter and outer diameter are 18mm and 45 mm, respectively, and its height is 80mm. It was made from 1.0mm diameter Bi-2212 wire with the length of 110 m. The wire was insulated with TiO<sub>2</sub> paste. After the heat treatment at 5 MPa, the critical current of the magnet reach 340 A at 4.2 K and self field. The central field is calculated to be 5 T.

OM image of an Bi-2212 wire cross section with 666 filaments



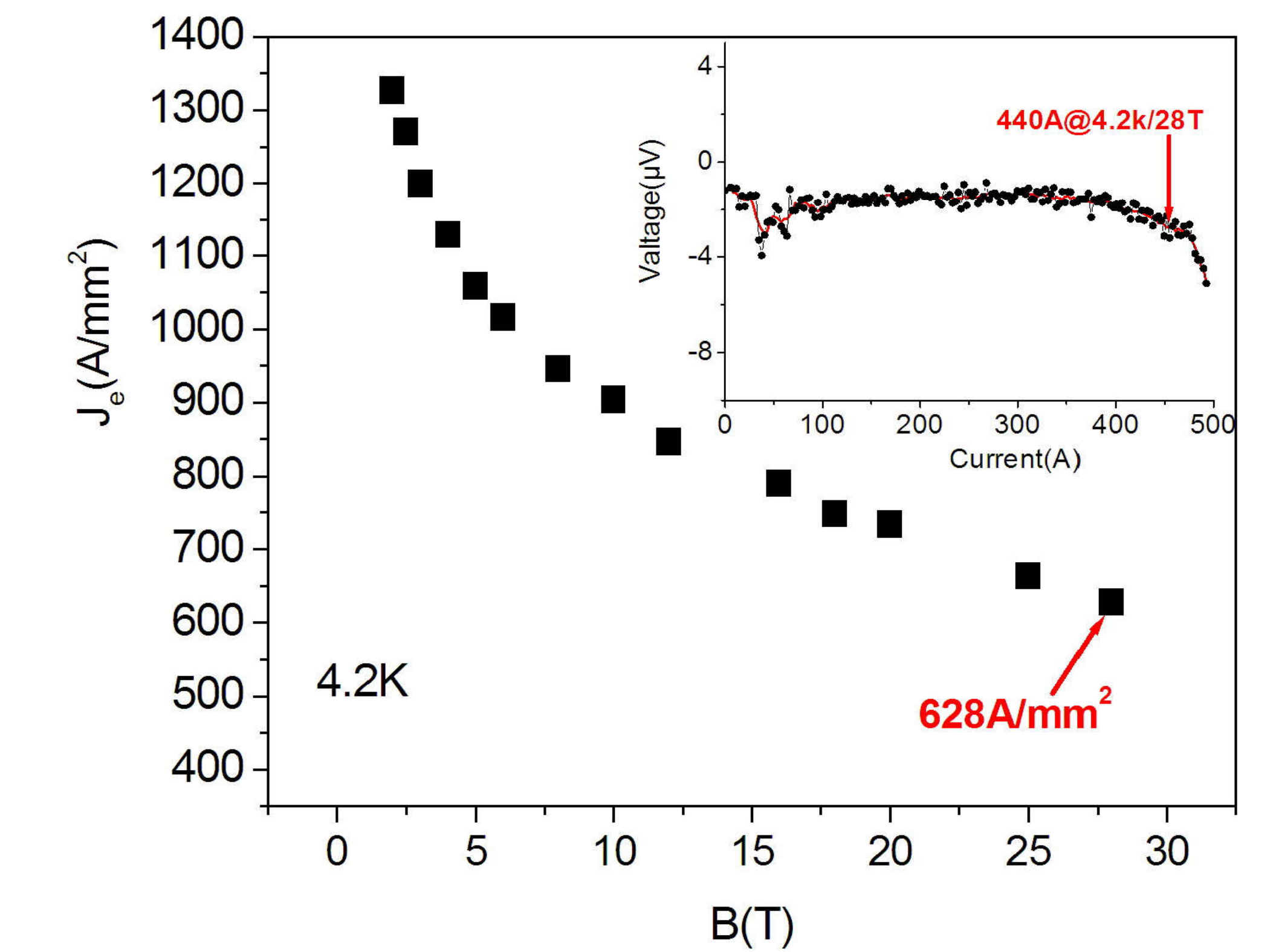
SEM image of the filaments after melt-processing with 5Mpa pressure



Picture of the Bi-2212 wire with length of 500m



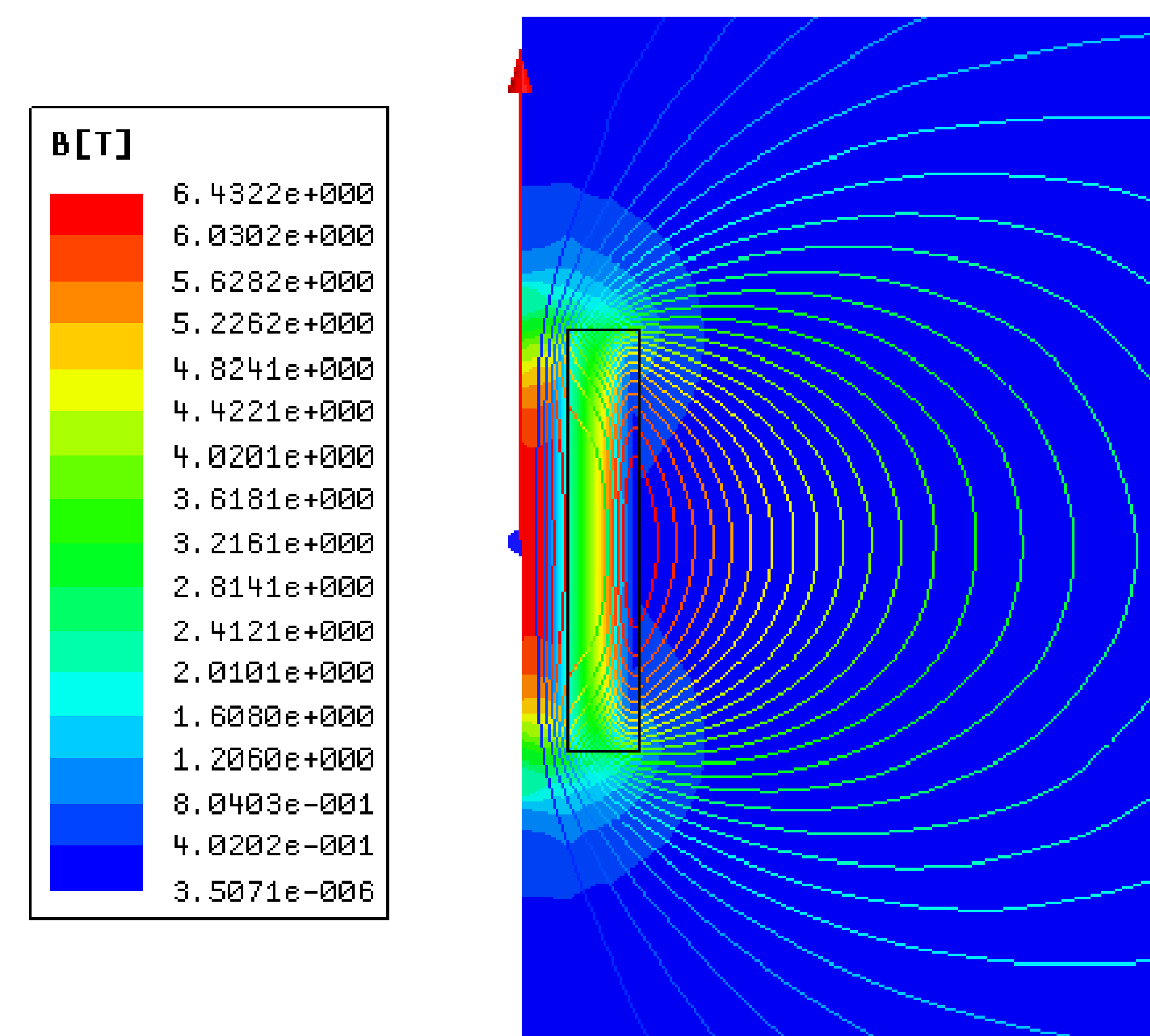
Engineering critical current density as a function of applied field



Magnet design

Designed Parameters of the Bi-2212 magnet	
Inner diameter /mm	18
Outer diameter /mm	45
Height /mm	80
Operating Current /A	400
Center Field /T	6T
Operating Current /mH	9
Superconductor	Bi-2212/Ag
Wire diameter/mm	1.0
Filaments	666
Insulation	TiO <sub>2</sub>
Length /m	110

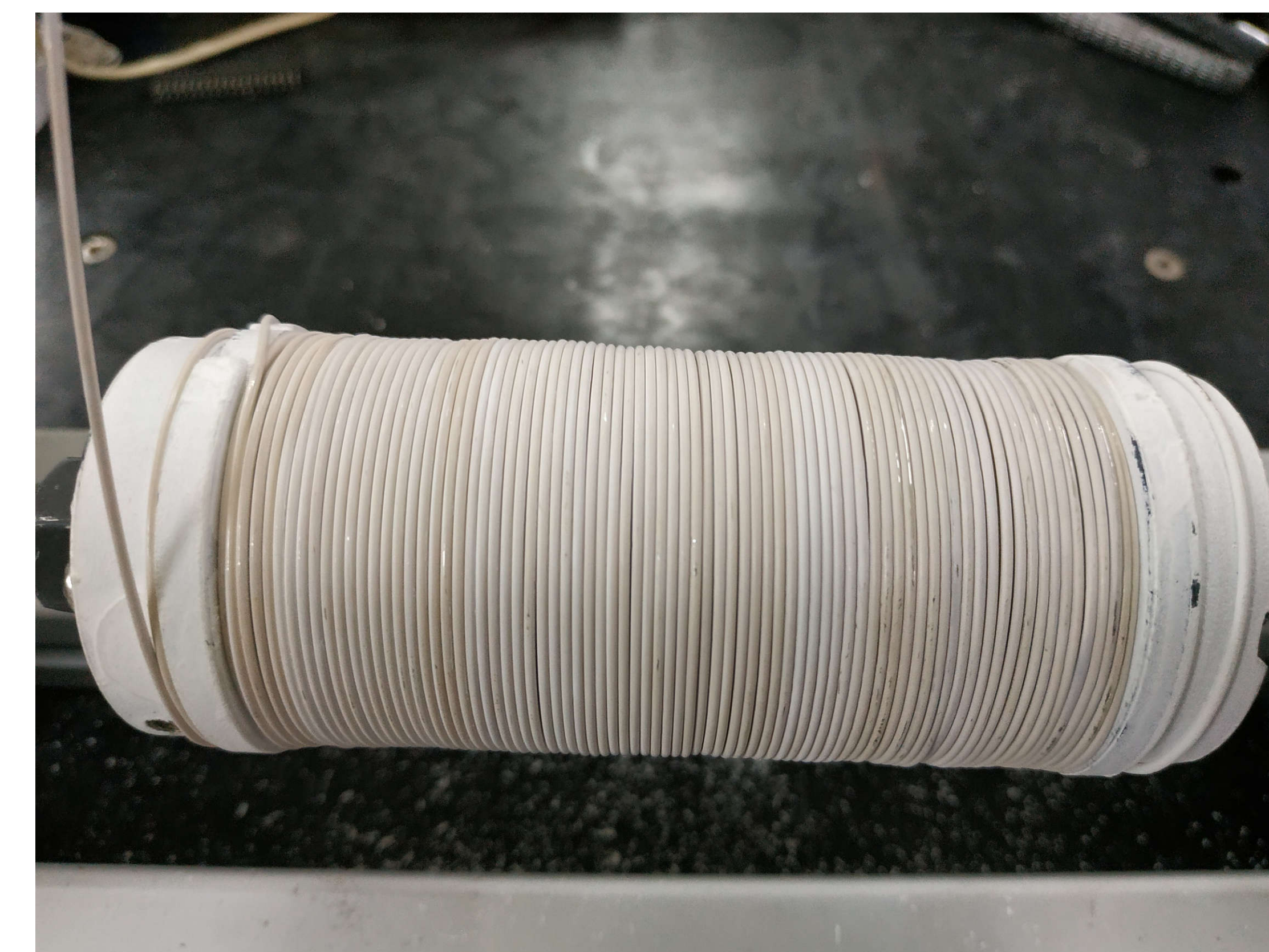
Magnetic field distribution



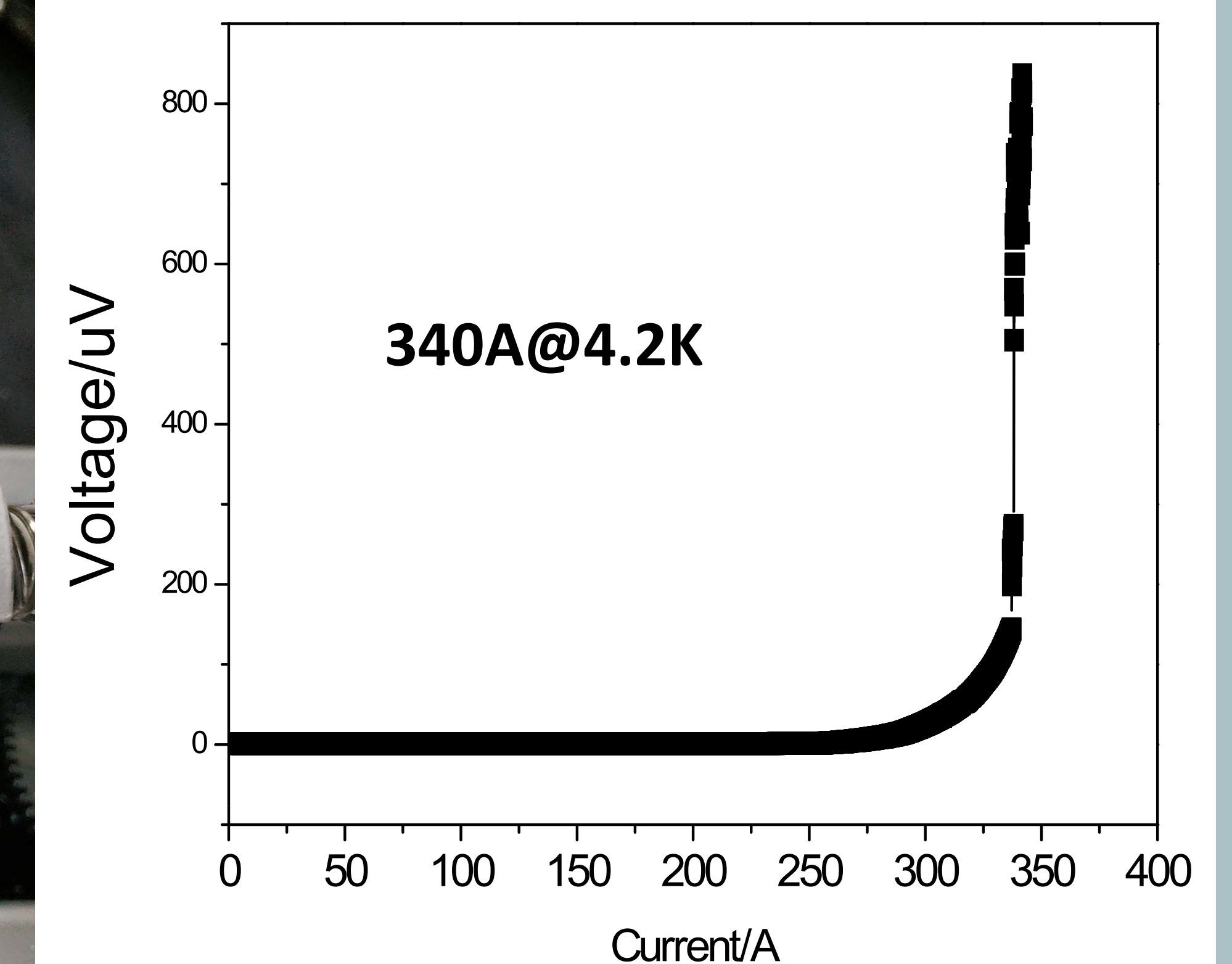
Wind process



Picture of the Bi-2212 magnet



Critical current test



Bi-2212 Wires

The Bi-2212 Magnet