Physical Properties of Hole-doped Ba$_{1-x}$K$_x$Fe$_2$As$_2$ Superconducting Films

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Among pnictide superconductors, the hole-doped Ba$_{1-x}$K$_x$Fe$_2$As$_2$ superconductor is very promising material for applications because of its relatively high critical temperature and high upper critical field. We have fabricated $c$-axis-oriented potassium-doped BaFe$_2$As$_2$ superconducting films on sapphire substrates under high vacuum condition by using an ex-situ pulsed laser deposition system. The films were investigated for their physical properties. The films show high superconducting critical temperature of around 40 K. The critical current density of the order of $10^6$ A/cm$^2$ was estimated from the M-H loops by using Bean’s critical state model. The upper critical field for our films was estimated to be high whereas the lower critical field was obtained to be low as compared to potassium-doped BaFe$_2$As$_2$ single crystals.