

## Raman Scattering Spectroscopy of $\text{Nd}_{1+x}\text{Ba}_{2-x}\text{Cu}_3\text{O}_7$ Coated Conductors Grown by Pulsed Laser Deposition

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We analyzed  $\text{Nd}_{1+x}\text{Ba}_{2-x}\text{Cu}_3\text{O}_7$  (NdBCO) coated conductors grown at various substrate temperatures by using Raman spectroscopy. Epitaxial NdBCO films were deposited on IBAD-YSZ templates by pulsed laser deposition. Raman scattering spectroscopy shows that the NdBCO film grown at relatively low substrate temperature of 750°C contains some *a*-axis oriented grains as well as *c*-axis oriented grains and an excess cation-disorder between  $\text{Nd}^{3+}$  ions and  $\text{Ba}^{2+}$  sites, which result in degradation of superconducting properties with critical temperature ( $T_c$ ) of ~83 K and critical current density ( $J_c$ ) of less than 1 MA/cm<sup>2</sup> at 77 K and self-field. The samples grown at higher temperature ranging from 775 to 800°C are found to have strong *c*-axis orientation with little cation-disorder, and subsequently, excellent superconducting properties with  $T_c$  of 88 ~ 90 K and  $J_c$  of 1.2 ~ 1.8 MA/cm<sup>2</sup> at 77 K and self-field.