We have investigated the phase stability of YBa$_2$Cu$_3$O$_{7-\delta}$ (YBCO) in low oxygen pressures (1 ≤ PO$_2$ ≤ 300 mTorr). In order to confirm the phase stability boundary and decomposition product of YBCO, Y-Ba-Cu-O amorphous precursor film deposited on LaAlO$_3$ (001) substrates at 200°C by pulsed laser deposition (PLD) were annealed at various high temperatures in low oxygen pressures. Experimental results commonly reveal that YBCO is decomposed into Y$_2$O$_3$ and YBa$_2$Cu$_3$O$_{6.5}$ and other phases in this low PO$_2$ region, which is quite different from the well-known peritectic decomposition of YBCO into Y$_2$BaCuO$_5$ + L in high oxygen partial pressures. In this presentation, details on phase stability and decomposition reaction of YBCO phase in low oxygen pressures will be discussed.

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