Influence of oxygen partial pressure on growth of the (Hg,Re)-1223 intergrain junction

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Samples of $Hg_{0.82}Re_{0.18}Ba_2Ca_2Cu_3O_{8+d}$ were successfully prepared by solid-vapour reaction technique. Firstly, preparation of the ceramic precursor typical began with a mixture of $Ba_2Ca_2Cu_3O_x$ and ReO_2 in powder form with the molar relationship 1 : 0.18. It is known that the oxygen stoichiometry may be modified and controlled through the thermal treatment. Then, the obtained precursor material was then submitted to an annealing with three different partial pressure of oxygen: 5% of O_2 and 95% of Ar (sample A), 10% of O_2 and 90% of Ar (sample B) and 15% of O_2 and 85% of Ar (sample C). The doping state was confirmed by XRD analysis and by observing distinct thermopower values at room temperature. In addition, the intergrain regions have shown an improvement in the critical current density when using the precursor preparation with 10% O_2 and 90% Ar (optimal doped). The optimal doped sample has presented the highest α exponent of the $J_c \propto \left[1 - \left(T/T_c\right)^2\right]^\alpha$ dependence. For the case of (Hg,Re)-1223 polycrystalline superconductor applications, the α exponent can be used as a junction quality parameter.