Search for improved synthesis and enhanced properties of the Mo-substituted $YBa_2Cu_3O_{7-d}$

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By studying the polycrystalline and single-crystals of the Mo-substituted $YBa_2Cu_3O_{7-d}$ superconductors when the Mo is in the CuO chain region of the structure we have shown that the density of critical currents can be significantly increased by the extended defects made of the coupled MoO_6 octahedra that produce local disturbance with the size similar to the coherence length.[1,2] Our studies demonstrated promising results for enhanced critical currents density in crystals annealed under high pressure oxygen by 3-4 times at temperatures 4-35 K and $\mu_0 H$ = 1-8 T, and by 9-11 times at 65-75 K and $\mu_0 H$ = 2-3 T.[3] However, the synthesis conditions required to keep the Mo away from the CuO_2 planes and to tune the optimum oxygen content were too complex to use these materials for applications. We summarize here our recent efforts intended to simplify the synthesis, increase the superconducting T_c as well as to achieve higher critical currents and critical magnetic fields. This work involved additional substitutions with the small size cations for Cu and the use of larger Rare Earth's for Y.[4] These substitutions lead after the synthesis under normal pressures to the similar superconducting transition temperatures of 93 K for the $NdBa_2Cu_3O_{7-d}$ with the small ion Ge as observed for the samples annealed under high oxygen pressure, thus meeting the criteria for the further studies of their critical currents. No traces of the new phases have been detected with the T_c's higher than the known for the substituted $YBa_2Cu_3O_{7-d}$ compounds.

References

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