

# Tensile properties of DyBaCuO low porosity bulk material melt-processed in oxygen atmosphere

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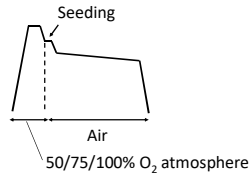
## Introduction

It is well-known that REBaCuO, where RE denotes rare-earth elements, superconducting bulk materials can trap large magnetic field in the compact space. Since REBaCuO bulk materials are subjected to electro-magnetic force, improvements of the mechanical properties of REBaCuO bulk materials are indispensable for the development of high-performance devices. However, conventional REBaCuO bulk materials melt-processed in air contain pores. Pores cause degradation of the mechanical properties due to the reduction of net cross-sectional area and stress concentration around pores. In this study, the mechanical properties of a DyBaCuO low porosity bulk material melt-processed in 100% O<sub>2</sub> atmosphere were evaluated through tensile tests for specimens cut from the bulk material. DyBaCuO bulk materials melt-processed in 50 and 75% O<sub>2</sub> atmosphere were also evaluated for comparison.

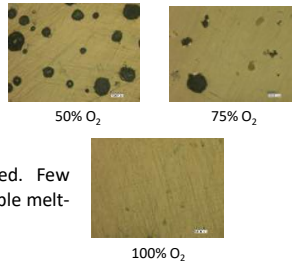
## Conclusion

The mechanical properties of DyBaCuO low porosity bulk materials melt-processed 50, 75 and 100% O<sub>2</sub> atmosphere were evaluated through tensile tests for specimens cut from the bulk materials. The porosity was decreased by the increase of O<sub>2</sub> pressure in the melt-processing. Few pores were observed for the bulk material processed in 100% O<sub>2</sub> atmosphere. The tensile strength was improved by the decrease of the porosity. Flow like patterns formed by the crack propagations were observed on the fracture surfaces of the specimens. Through the observations for the flow like patterns, it was found that the fatal cracks of the porous specimens were initiated from pores. On the other hand, the fatal cracks of the dense specimens with no pores were initiated from Pt inclusions.

## Bulk samples



Samples	Dy211 [mol%]	Ag [wt%]	Pt [wt%]	Melt-process	Size [mm]
Dy50	25	0	0.5	In 50% O <sub>2</sub>	φ30x10
Dy75	25	0	0.5	In 75% O <sub>2</sub>	φ30x10
Dy100	25	0	0.5	In 100% O <sub>2</sub>	φ30x10



Three bulk samples were prepared. Few pores are observed for the bulk sample melt-processed in 100% O<sub>2</sub> atmosphere.

## Tensile test procedures



Specimens were glued to metal rods with epoxy resin. Tensile load was applied through the universal joints.

Detached specimens.

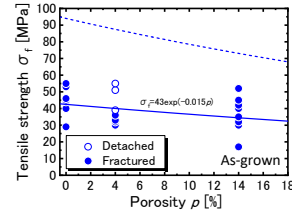
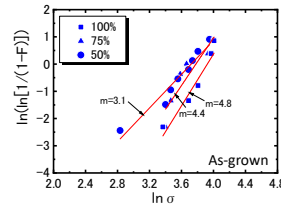
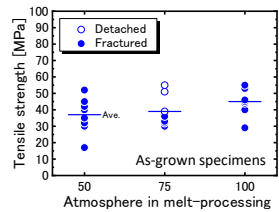
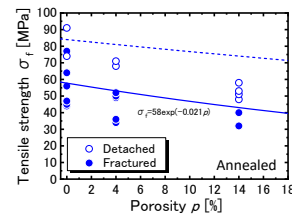
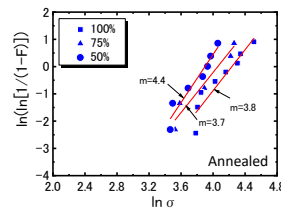
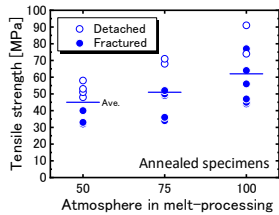
Bending tests.

Mechanical properties of REBaCuO bulk materials are commonly evaluated through bending tests. However, the strength values evaluated through the bending tests are overestimated.

## Acknowledgment

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## Tensile test results

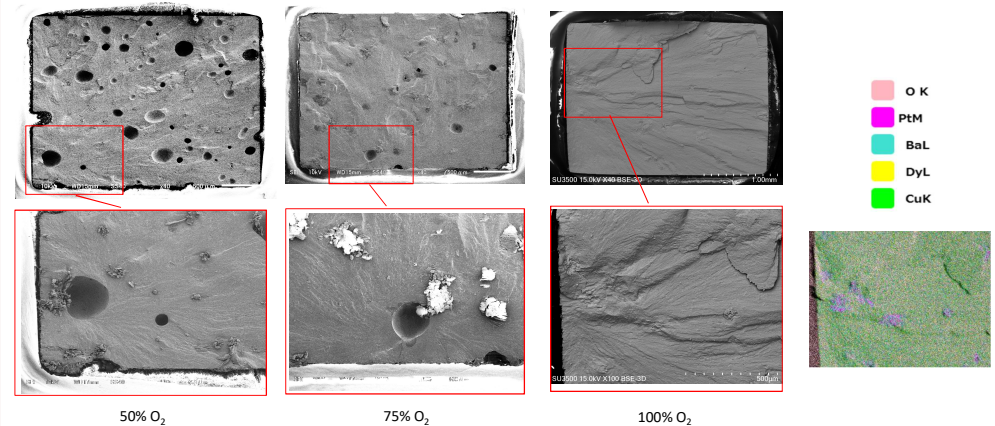


Tensile strength of as-grown and annealed specimens cut from bulk samples melt-processed in 50, 75 and 100% O<sub>2</sub> atmosphere.

Weibull plots of tensile strength of as-grown and annealed specimens.

Relationship between tensile strength and porosity. Broken lines are approximation curves based on the bending tests.

## Fracture surface observations



Flow like patterns formed by the crack propagations were observed on the fracture surfaces. The fatal cracks of the dense specimens with no pores were initiated from Pt inclusions.