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## 藕状多孔铜沿垂直于气孔方向的压缩变形行为与本构关系

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**摘 要:** 采用定向凝固法, 在氢气压力为0.2 MPa, 熔体温度为1 200 °C的条件下制备 $d$  45 mm×120 mm的藕状多孔纯铜棒材, 研究藕状多孔金属垂直于气孔方向的压缩变形过程及其影响因素, 分析压缩变形机理。结果表明: 藕状多孔铜沿垂直于气孔方向的压缩变形过程可分为弹性变形、气孔的塑性屈曲、气孔的密实化和密实化后的塑性变形4个阶段, 其中塑性屈曲阶段的主要变形机理为多孔材料在垂直载荷的作用下先后形成若干个变形带, 在变形带内圆形气孔先后以压扁和塌陷的方式进行塑性变形; 采用回归分析方法建立藕状多孔金属沿垂直于气孔方向的压缩变形本构关系。

**关键字:** 气体/金属共晶定向凝固; 藕状多孔金属; 压缩变形; 变形行为; 本构关系

## Deformation behaviors and constructive relation of lotus-type porous copper under compressive direction perpendicular to pores

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**Abstract:** The lotus-type porous copper bars with 45 mm in diameter and 120 mm in length were fabricated by unidirectional solidification at hydrogen pressure of 0.2 MPa and molten temperature of 1 200 °C. The compressive deformation process of the lotus-type porous copper with pore perpendicular to the compressive direction and its effect factors were investigated. The deformation mechanism of lotus-type porous copper with pores perpendicular to the compressive direction was also analyzed and discussed. The results show that the deformation of the lotus-typed porous copper consists of four stages of elastic deformation, plastic yield deformation, densification and plastic deformation after densification. The main deformation mechanism in the plastic yield stage is that several deformation bands generate sequentially under the perpendicular loading, and in these deformation bands the pores are deformed by flattening and collapsing sequentially. Based on the above results, the compressive mechanical model of the lotus-type porous metals with pores perpendicular to the compressive direction is established using the method of linear regression.

**Key words:** gas-metal eutectic unidirectional solidification; lotus-type porous metal; compressive deformation; deformation behaviors; constitutive relation

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