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纳米晶软磁材料Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉中子衍射研究

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摘要 用中子衍射技术研究了3种不同热处理温度下形成的纳米晶软磁材料Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉的内部微观结构及其随热处理温度的变化。实验结果表明:Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉非晶经等温热处理1h后,生成的是高度有序的DO₃结构的固溶体Fe₃Si(Fe)。首次确定了Si主要占据4a位,Fe除少量占据4a位外,主要占4b和8c位,并定量地给出了上述3种样品的Si的占位数和平均晶粒尺寸。另外,热处理温度为853K时,样品晶胞变大,有部分B原子进入48h位。热处理温度为823K时,样品具有最高的Si含量(原子百分比19.8%)和最小的晶粒尺寸(8.9nm),这可能是样品有最佳软磁性能的原因。

关键词 [纳米晶软磁材料](#) [Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉](#) [中子衍射](#)

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Diffraction Study on the Nanocrystalline Soft Magnetic Material Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉

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Abstract Neutron diffraction is performed on samples of the nanocrystalline soft magnetic material Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉ which are annealed at three different temperature for 1 h respectively. Results reveal that amorphous ribbons of Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉ are turned into a well ordering solid solution Fe₃Si(Fe) with DO₃ structure which is different from the Fe(Si) solid solution with bcc structure after they were annealed. And Si atoms and a few Fe atoms occupy the 4a site and Fe atoms mainly occupy the 4b and 8c sites, and the content of Si atom as well as the average grain dimension of nanocrystalline. Especially, the reason that cell parameter enlarged is some B atoms go into the 48h site in 3 # (853 K) sample. It is obvious that 2 # (823 K) sample has the highest content of Si atom and the minimum average grain dimension (8.9 nm) comparing the results of the three samples. It seems the reason that the 2 # (823 K) sample has the best soft magnetism properties.

Key words [nanocrystalline soft magnetic material](#) [Fe_{73.5}Cu₁Nb₃Si_{13.5}B₉](#) [neutron diffraction](#)

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