

论文

非晶金刚石薄膜对温度的敏感性研究

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摘要

采用过滤阴极真空电弧技术制备非晶金刚石薄膜, 在-190~600℃范围研究非晶金刚石薄膜的温度敏感性. 利用液氮泵在Linkam试验台上冷却样品并实时采样, 通过炉中退火实现样品加热. 分别测试可见光拉曼光谱和纳米压痕, 研究薄膜的微结构和机械性能的变化. 实验表明: 过滤阴极真空电弧制备的非晶金刚石薄膜具有较好的热稳定性. 在空气中退火到400℃, 其硬度和弹性模量基本保持不变, 其结构可以一直稳定到500℃, 但是到600℃, 薄膜因为氧化作用而快速消耗. 非晶金刚石薄膜的可见光拉曼光谱显示随着温度的升高, 谱峰峰位向高频偏移. 在低温冷却过程中, 薄膜对温度变化不敏感, 其结构保持不变.

关键词 [非晶金刚石](#) [过滤阴极真空电弧](#) [温度敏感性](#) [拉曼光谱](#)

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Temperature-dependent Microstructural Properties of Amorphous Diamond Films

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Abstract

The temperature sensibility of amorphous diamond (a-D) films deposited with the filtered cathodic vacuum arc technology was investigated in the range of -190-600℃. The samples cooled by liquid nitrogen pump were *in-situ* measured on a Linkam stage and the samples for thermal stability were heated in a furnace. The microstructure and mechanical properties were respectively examined by visible Raman spectroscopy and a nanoindenter. The results show that a-D films have better thermal stability in air, they can hold their hardness up to 400℃ and hold their structure up to 500℃. However, the complete material loss takes place at about 600℃. Raman measurements show an apparent shift of the G-peak frequency to higher values with increasing annealing temperatures. The films are not sensitive to lower temperatures. The microstructure of the films remains stable as temperatures are decreased to -190℃.

Key words [amorphous diamond](#) [filtered cathodic vacuum arc](#) [temperature sensibility](#) [Raman spectroscopy](#)

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