SW-P011

Lateral p-n junction Diode with organic single crystal by direct printing

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We fabricate organic single crystal nanowire heterojunction p-n diode poly(3-hexylthiophene)(P3HT) and from Phenyl-C61-butyric acid methyl ester(PCBM) using by liquid-bridge mediated nanotransfer molding(LB-nTM) method. LB-nTM has been reported an one step direct printing method for making well-aligned nanowire arrays. Moreover, multi-patterning nanostructures can be fabricated with the consecutive printing process. As a result, it is possible to make simple and basic concept of heterojunction devices such as lateral organic p-n nanojunction diode. P3HT/PCBM nanowires heterojunction diode has rectifying behavior with on/off ratios of ~20

Keywords: organic single crystal, p-n junction diode

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Tribological study on the thermal stability of thick ta-C coating at elevated temperatures

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Diamond-like carbon (DLC) coatings have been widely applied to the mechanical components, cutting tools due to properties of high hardness and wear resistance. Among them, hydrogenated amorphous carbon (a-C:H) coatings are well-known for their low friction properties, stable production of thin and thick film, they were reported to be easily worn away under high temperature. Non-hydrogenated tetrahedral amorphous carbon (ta-C) is an ideal for industrial applicability due to good thermal stability from high sp^3-bonding fraction ranging from 70 to 80 %. However, the large compressive stress of ta-C coating limits to apply thick ta-C coating. In this study, the thick ta-C coating was deposited onto Inconel alloy disk by the FCVA technique. The thickness of the ta-C coating was about 3.5 μm. The tribological behaviors of ta-C coated disks sliding against Si_3N_4 balls were examined under elevated temperature divided into 23, 100, 200 and 300 ℃. The range of temperature was setting up until peel off observed.

The experimental results showed that the friction coefficient was decreased from 0.14 to 0.05 with increasing temperature up to 200 ℃. At 300 ℃, the friction coefficient was dramatically increased over 5,000 cycles and then delaminated. These phenomenon was summarized two kinds of reasons: (1) Thermal degradation and (2) graphitization of ta-C coating. At first, the reason of thermal degradation was demonstrated by wear rate calculation. The wear rate of ta-C coatings showed an increasing trend with elevated temperature. For investigation of relationship between hardness and graphitization, thick ta-C coatings(2, 3 and 5 μm) were additionally deposited. As the thickness of ta-C coating was increased, hardness decreased from 58 to 49 GPa, which means that graphitization was accelerated.

Therefore, now we are trying to increase sp^3 fraction of ta-C coating and control the coating parameters for thermal stability of thick ta-C at high temperatures.

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Keywords: Thick ta-C, FCVA, tribology, elevated temperature