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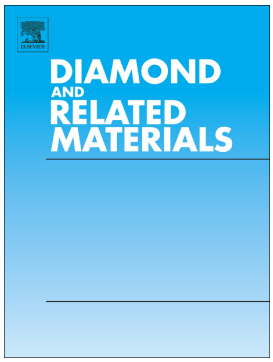

Structure and lubricated tribological behavior of silicon incorporated carbon nitride composite films deposited by magnetron sputtering

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Structure and lubricated tribological behavior of silicon incorporated carbon nitride composite films deposited by magnetron sputtering

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Abstract: Silicon incorporated C-N films were prepared by ion beam assisted magnetron sputtering using silicon/graphite composite target. The microstructure of the Si-C-N films were characterized by SEM, XPS, TEM and Raman spectroscopy. Mechanical and lubricated tribological behavior of the films were investigated by the nano-indentation experiments and ball-on-disc tribotest in Hank's solution. With the increase of silicon target fraction ($F_{T\text{-}Si}$), the silicon content steadily increased from 1.8 to 15.8 at.% with a simultaneous decrease in the C content from 78 at.% to 56 at.%. The N content slightly decreased from 25.2 at.% to 19.8 at.%, and silicon and N content is saturated as the $F_{T\text{-}Si}$ reaches about 50 at.%. The hardness and elastic modulus increased with the $F_{T\text{-}Si}$, while the average friction coefficient decreased with the $F_{T\text{-}Si}$ increase. The C-N films deposited at a $F_{T\text{-}Si}$ of 10 vol.% show the lowest coefficient of friction of 0.049, and exhibited good mechanical and lubricated tribological properties.

Keywords: Hardness, Tribological, Elastic modulus, Nano-indentation, Friction coefficient

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