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Improvement of adhesion strength and scratch resistance of fluorocarbon thin films by cryogenic treatment

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Abstract

Fluorocarbon thin films have been widely applied as protective coatings due to unique physical and chemical properties, but the scratch resistance and adhesion strength between the films and substrates are rather poor. Coating technologies for stronger scratch resistance and adhesion strength are definitely needed and have great significance in coatings applications of fluorocarbon thin films. In this work, the scratch resistance and adhesion strength between silicon substrates and fluorocarbon thin films deposited by radio frequency (R.F.) magnetron sputtering were improved via a remarkably simple, flexible and nondestructive cryogenic treatment method. The effect of the cryogenic treatment on the microstructure, hardness, adhesion strength and scratch resistance of fluorocarbon thin films were investigated. XPS results indicated that the content of fluorine decreased slightly and the amount of cross-linked units increased after cryogenic treatment. Furthermore, the hardness of fluorocarbon thin films slightly improved. Nano-scratch test revealed that fluorocarbon thin films after this treatment had excellent scratch resistance and good adhesion strength.

Keywords: Fluorocarbon thin films; R.F. magnetron sputtering; Adhesion strength; Scratch resistance

1. Introduction

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