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Hydrogen plasma etching of silicon dioxide in a hollow-cathode system

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Chemical etching of various materials has been observed when hydrogen plasmas are used in material processing. In the case of the deposition of diamond films the preferential etching of sp^2 bonded carbon is considered to be of fundamental importance. Similarly, recent reports have described the growth of crystalline silicon films by the low temperature atomic hydrogen etching of a silicon source and the deposition by the thermal decomposition of the etched molecules on a hot substrate. A few papers have been published which have indicated that etching by hydrogen ions is different to that by hydrogen atoms. In this paper we describe the etching of silicon dioxide by hydrogen which was plasma-activated in a molybdenum-lined RF hollow cathode. The etch rate was seen to be thermally activated but decreased with increasing plasma power. The addition of a few percentage of helium increased the etch rate. The application of a -50 V bias to the sample holder almost doubled the etch rate indicating the importance of ion bombardment for the chemical reaction. At high plasma powers and substrate temperatures in excess of 450 ^{o}C a thin molybdenum deposit was formed on the quartz samples.

Keywords
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