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Surface chemistry of the preferred (111) and (220) crystal oriented microcrystalline Si films by radio-frequency plasma-enhanced chemical vapor deposition HAJIME SHIRAI, DAISUKE OHBA, ZEGUO TANG, CHIEN-HUI LAI, Saitama University, SHIRAI TEAM — The surface chemistry of chlorinated hydrogenated microcrystalline silicon (μc-Si:H:Cl) films with preferred (111) and (220) crystal orientations was investigated using a radio-frequency (rf) plasma-enhanced chemical vapor deposition (PE-CVD) of a dichlorosilane (SiH_2Cl_2) and H_2 mixture. The growing surface for the preferred (220) crystal oriented μc-Si:H:Cl films included much micro-roughness, voids, and dangling bonds, which was chemically active to the hydrogen and argon plasma exposure. On the other hand, the growing surface with the preferential (111) crystal orientation was chemically stable relatively. These findings suggest that the sticking process of deposition precursors and/or the reconstruction of Si clusters within the sub-surface region including micro-roughness and dangling bond determine the growth of the preferential (220) crystal orientation. The determining factor for the preferential crystal orientation is discussed in the growth of μc-Si:H:Cl films.

Hajime Shirai
Saitama University

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