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Preparation of hydrogenated diamond-like carbon films by reactive Ar/CH_4 high power impulse magnetron sputtering with negative pulse voltage[1] TAKASHI KIMURA, HIKARU KAMATA, Nagoya Institute of Technology — High power impulse magnetron sputtering (HiPIMS) has been attracted, because sputtered target species are highly ionized. High densities of active species such as radical ions and neutral radicals can be also achieved owing to high density reactive HiPIMS plasmas. We investigate properties of hydrogenated diamond-like carbon films prepared by reactive HiPIMS of Ar/CH_4 gas mixture. The properties of the films strongly depend on the plasma compositions and the kinetic energy of the carbon-containing ions which can enter into the films. The film preparation is performed at an average power of 60 W and a repetition frequency of 110 Hz, changing CH_4 fraction up to 15%. Total pressure ranges between 0.3 and 2 Pa. The maximum of instantaneous power is about 20-25 kW, and the magnitude of the current is 36 A. A negative pulse voltage is applied to the substrates for about 10 μs after the target voltage changed from about -600 V to 0 V. The structural properties are characterized by Raman spectroscopy and nano-indentation method. Film hardness strongly depends on the magnitude of negative pulse voltage. By adjusting the magnitude of negative voltage, the film hardness ranges between about 10 and 22 GPa.

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