Changing pattern of N_2 dissociation in N_2-Ar RF plasma during E–H mode transition

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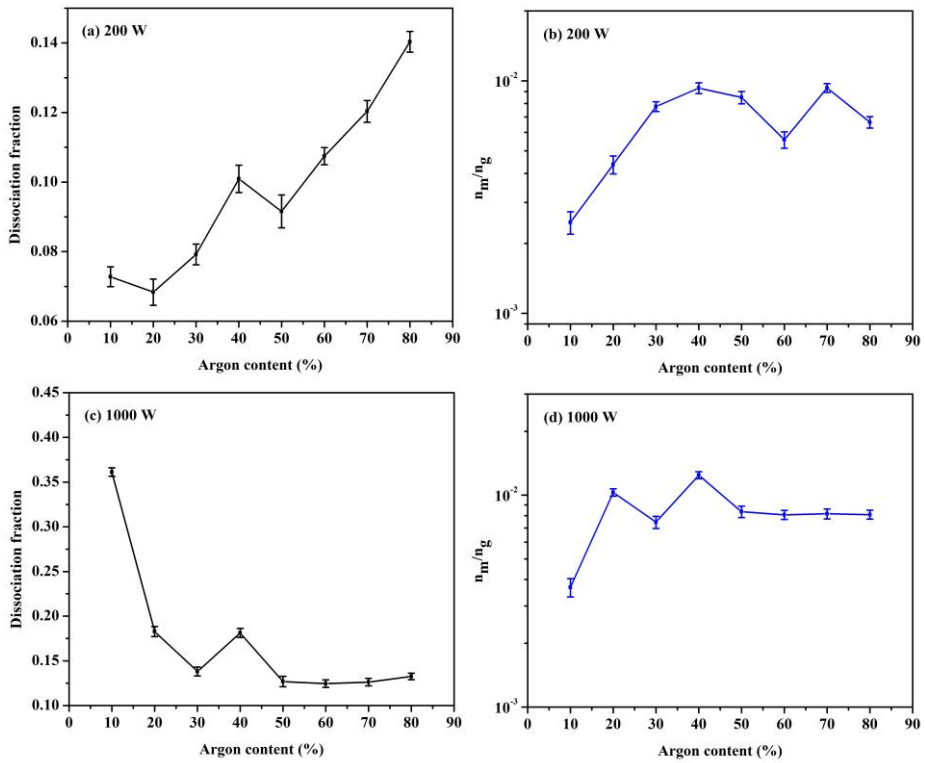

Fig: Variation of dissociation fraction of nitrogen molecule for (a) 200 W and (c) 1000 W and argon metastable fraction for (b) 200 W and (d) 1000 W of applied RF power against the argon concentration at 5 × 10^{-3} mbar working pressure.

Atomic nitrogen has a broad range of applications in the material processing domain ranging from the nitridation of different metals and the synthesis of nitride thin films in semiconductors to various types of etching, cleaning, deposition etc. However, due to its high bond energy (15 eV) breaking a nitrogen molecule into two atomic nitrogen, called dissociation, is quite difficult. In our experiment, it is observed that adding argon with nitrogen plasma increases the dissociation in the low RF power domain (E-mode). This increase in dissociation is primarily caused by the growing concentration of argon metastable state (Ar*) and the process is known as Penning dissociation.

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