Collisionally radiative models for high-frequency capacitive discharge in argon [[1]](#footnote-1)\*)

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Voloshin D.G.

Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia, info@sinp.msu.ru

Argon based low-temperature plasmas are widely used both for fundamental process research and in technology applications. Ar excited states are important components in the gas discharge physics and processes. The long-lived excited species act as energy reservoirs and have an influence on the discharge structure through the energy transfer to other species and surfaces. VUV photons from the Ar resonance states can substantially influence the properties of the processing materials, both in positive (sterilization of surfaces, curing of polymers) and negative (low-k dielectrics damage) ways. In this sense the simulation of plasma processing discharges should correctly predict the Ar excited states densities in the plasma.

In this work the usage of collision-radiative models in kinetic simulation of high frequency capacitively coupled plasma discharge on the base of Partice in cell method with Monte-Carlo collisions was studied.

Different sets of Ar excited states was included in the model: from the simple one with the total description of metastable and resonance states [1], to the more detailed scheme with four lower 1s levels and two effective higher levels [2] and to the detailed scheme in [3] with the 14 levels (4 lower 1s- states and 10 2p- states) and different radiative and electron transitions between these states. The cross sections in this different sets were normalized to correspond to the total energy losses in inelastic collisions. This normalization is necessary to get the correct electron energy distribution function, especially when using cross sections obtained from quantum mechanical calculations.

The experimental results from [3, 4] for Ar(1s) densities was used to verify the self consisted kinetic calculations. The reduced sets of Ar excited states, which give the necessary information about concentration of metastable and radiative states, but not complicate too much the PIC simulation are presented.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Lt/ru/EY-Voloshin.docx) [↑](#footnote-ref-1)