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Monte Carlo simulations of neon versus helium ion beam induced deposition, sputtering and etching RAJENDRA TIMILSINA, DARYL SMITH, The Unviersity of Tennesse at Knoxville, Tennessee, PHILIP RACK, The Unviersity of Tennesse at Knoxville, Tennessee and Center for Nanophase Materials Sciences Oak Ridge National Laboratory, Oak Ridge, — The ion beam induced nanoscale synthesis of PtCx (where x $\sim$ 5) using the trimethyl (methylcyclopentadienyl)platinum(IV) ($MeCpPt^{IV}Me_3$) precursor is investigated by performing Monte Carlo simulations of helium and neon ions. The helium beam leads to more lateral growth relative to the neon beam because of its larger interaction volume. The lateral growth of the nanopillars is dominated by molecules deposited via secondary electrons in the both simulations. Notably, the helium pillars are dominated by SE-I electrons whereas the neon pillars by SE-II electrons. Using a low precursor residence time of 70μs resulting in an equilibrium coverage of $\sim$ 4%, the neon simulation has a lower deposition efficiency (3.5%) compared to that of the helium simulation (6.5%). At larger residence time (10ms) and consequently larger equilibrium coverage (85%) the deposition efficiencies of helium and neon increased to 49% and 21%, respectively; which is dominated by increased lateral growth rates leading to broader pillars. The nanoscale growth is further studied by varying the ion beam diameter at 10 ms precursor residence time. The study shows that total SE yield decreases with increasing beam diameters for the both ion types. However, the helium has the larger SE yield as compared to that of neon in the both low and high precursor residence time, and thus pillars are wider in all the simulations studied.

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