Correlation between supersaturation and phase for the heterogeneous nucleation and coalescence of HgI_2 onto amporphous substrates

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HgI_2 99 % was purified by four evaporations at 300 ºC and an initial pressure of 10^{-3} Pa. The heterogeneous nucleation of HgI_2 onto glass was studied by the physical vapor deposition (PVD) method, with and without argon atmosphere. Glass substrates 2"x2" in area, with and without palladium coating, were used for nucleation and coalescence. Nucleation conditions, specially supersaturation, strongly determined nuclei population and size but also determined the HgI_2 nucleation phase. A range of nucleation temperature between 30 ºC and 60 ºC for the substrate and the same temperature of the source for each set, and a range of initial Ar pressure between 1.3–2.6 x 10^4 Pa were found as appropriate for nucleation of the α (red) phase of HgI_2. Other nucleation condition, as a temperature gradient between the source and the substrate or an argon pressure higher than 4 x 10^4 Pa, determine nucleation of the β (yellow HgI_2) phase metastable.
Nucleation took place by the Volmer Weber mechanism, with islands 1-2 μm in size, for both, α and β phase. Nuclei orientation was confirmed by X-ray diffraction and resulted to be with their (*0 0 l*) planes parallel to the substrate. Coalescence was performed annealing the substrate at a temperature between 30-60 ºC and from 5 minutes to 24 hours, at an initial argon pressure of 10^4 Pa. Nuclei coalesce to form larger islands, which, in the case of β phase nuclei also transform to the α stable phase. From the experimental nucleation and coalescence conditions, correlations between supersaturation conditions and nuclei phase were established; theoretical considerations about the surface adhesion energy (γ_{hkl}) were made. Future efforts will be conduted to improve nucleation uniformity, to better study nuclei properties and to search for coalescence and further growth better conditions.