Pulsed Laser Deposition under Low Background Gas Pressure.

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M. Kostejn[1], R. Fajgar[1], V. Drinek[1], V. Jandova[1], M. Klementova[2], S. Bakardijeva[3]
[1]Institute of Chemical Process Fundamentals of the CAS- v. v. i., Department of laser chemistry, Prague, Czech Republic
[2]Institute of Physics CAS, Department of Material Analysis, Prague, Czech Republic
[3]Institute of Inorganic Chemistry CAS, Centre of Instrumental Techniques, Husinec-Řež, Czech Republic

Properties of the layers prepared by pulsed laser deposition (PLD) was modified by background gas pressure. The background pressure is additional parameter of the deposition which is easily controllable. In dependence on the type of the gas, a chemical reaction or a nucleation of nanoparticles was initiated in evolving plume.

For initiating of a chemical reaction, a reactive gas SiH_4 or GeH_4 was used during a transition metal (Mn, Cr, etc.) ablation. The molecules of the reactive gas are decomposed by abundant energy of particles spreading from the target and material with mixed composition is formed. Variation of background pressure from 1 to 4 Pa of SiH_4, resp. from 1 to 2 Pa of GeH_4, resulted in deposition of compact layers with metal content from 20 to 50 at.%. Growth rate of this deposition was found between 5 and 15 nm/min in dependence on conditions. Annealing of these layers led to production of silicide and germanide nanostructures exhibiting ferromagnetic behaviour up to the room temperature.

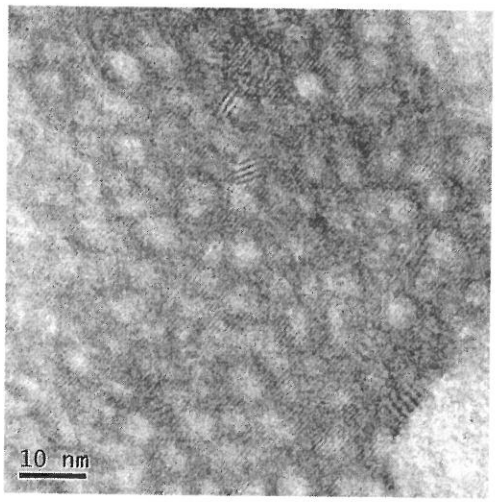

Fig. 1.

The nucleation of nanoparticles was applied during gold deposition onto TiO_2 layers. For nucleation, up to 10 Pa of inert gas (argon) was used. Argon molecules efficiently helped to cool temperature of evolving plume and initiated the nucleation which resulted in deposition of gold nanoislands. Gold nanoparticles incorporated in TiO_2 layers provided plasmonic properties. Au/TiO_2 layers were used for water splitting as proved by photoelectrochemical measurements.