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Laser-induced chemical vapour deposition of conductive and insulating thin films

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Investigations concerning the laser-induced chemical vapour deposition of Mo, W, Co and $TiSi_2$ conductive thin film structures from $Mo(CO)_6$, $W(CO)_6$, $Co_2(CO)_8$, $TiCl_4$ and SiH_4 using a direct writing method are presented. SiO_2 thin films were deposited from SiH_4 and N_2O in a large area deposition process stimulated by an excimer laser by using a parallel beam configuration.

1. Introduction

The preparation of conductive and insulating thin films plays an essential role in microsystems technology today. Laser-induced chemical vapour deposition is investigated as a supplement and alternative for conventional deposition processes like evaporation and CVD [1].

We investigated the laser-induced chemical vapour deposition of Mo, W, Co, and $TiSi_2$ conductive thin films using a direct writing method and we have deposited large-area SiO_2 films in an excimer laser parallel beam configuration.

2. Experimental

The direct writing experiments were carried out with a 10 W argon ion laser and a 200 W CO_2 laser in an experimental arrangement containing a gas handling system for parent gas supply and carrier gases, a vacuum pumping unit with an oil-sealed forepump and an oil diffusion pump and a stainless steel reaction chamber with substrate heating facility mounted on a computer-controlled x–y table. The laser beam can be focussed to a spot with a Gaussian radius of $r_G = 4$, 7 or 15 μm by changing the objectives for the argon ion laser experiments and to a spot with $r_G = 500$ μm for the CO_2-laser experiments [2].

The second experimental apparatus was used during the SiO_2-film deposition experiments. It consists of gas handling, pumping and scanning facilities and a reaction chamber that are similar to the direct writing arrangement described before. The ArF excimer laser beam is confined to a cross section of 3×8 mm^2 within the stainless steel reaction chamber using a lens telescope. The chamber can be moved in one direction by a simple mechanism.

3. Deposition parameters and results

The first series of experiments were directed to the argon ion laser-induced deposition of the refractory metals W and Mo from their respective