PVD synthesis of novel metastable solid solution oxide and oxinitride thin films

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The development of new oxide and oxinitride thin films for engineering applications is attracting enormous interest. Besides theoretical modelling of structural design and properties of such materials the systematic evaluation of plasma-based deposition routes towards their synthesis will contribute to create a substantial data base for future material development.

An experimental combinatorial approach to the synthesis of oxide and oxinitride thin films in the system Al-Cr-O-N will be presented. The thin films were deposited by reactive r.f. magnetron sputtering at 500 °C and 500 W r.f. target power under systematic variation of the reactive gas flows. Thin films with five different compositions were obtained in one deposition process by using a segmented Al:Cr sputtering target.

Under specific conditions, $(Al,Cr)_2O_3$, and $(Al,Cr)_2(O,N)_3$ films are grown in single-phase solid solution corundum-type crystal structure. The microstructure formation and phase stability will be discussed versus composition, pressure and the impact of nitrogen gas flow. It will be shown that the oxinitride materials can exhibit superior mechanical properties compared to the oxide materials.