

Towards a universal materials sequencing machine

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The concept of an automatic machine for the deposition of material sequences with controlled composition and microstructure is presented for the first time.

The machine has been designed to allow a computer system, possibly based on adaptive systems and artificial intelligence, to develop and carry out experiments in the synthesis of materials in order to achieve predetermined experimental goals.

The machine consists of a multi-target RF sputtering system that can accommodate up to 6 sources capable of operating simultaneously independently, both in sequence and in series, both with pure metal and oxide targets, in the presence of controlled residual atmospheres of both Ar and O₂. Each element of the sequence, or "spot", can be associated with a deposition temperature and a post-growth annealing temperature.

The sources can co-deposit samples in the form of small spots of materials on a metal strip, which advances allowing the creation of sequences with different composition and microstructure. Downstream of the deposition, the insertion of one or more characterization stations is envisaged to determine the functional properties of the nominal deposition sequence in relation to the achievement of a given objective.

The system will initially allow to implement various Design of Experiment algorithms for the creation of predefined sequences starting from three sources, and in perspective to operate independently for the achievement of certain objectives after the implementation of the related functional characterization. The machine will be applied to the determination of new formulations and cathode structures for ionic accumulators.