Structuring of thin films combining reactive gas pulsing and GLAD

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The GLancing Angle Deposition (GLAD) is a recent technique to play with the structure of thin films [1]. It was successfully developed to sputter deposit thin films exhibiting original architectures. This approach employs oblique angle deposition and controlled substrate motion to form a film composed of nanometer scaled columns of designed shape. It allows the growth of compounds with a carefully engineered structure at the sub-micron scale. Thus, various forms (zigzags, spirals, oriented columns and so on) through the film thickness can be produced, which give rise to new geometries of the film structure [2,3]. On the other hand, the Reactive Gas Pulsing Process (RGPP) is also a recent method to control the amount of reactive gas injected during the film deposition, and finally to play with the nature of the deposited material [4,5].

This presentation aims at illustrating how physical properties and anisotropic behaviors thin films based-on metals, oxides, nitrides and oxynitrides prepared by sputtering can be modified involving RGPP, or GLAD, or even by combining simultaneously these two techniques RGPP + GLAD. The basic principle of these "young" techniques will be presented in terms of key parameters and reachable architectures. Some characteristics of as-deposited thin films will be discussed especially showing the correlations between the dimensions, shapes and geometries of produced architectures and the resulting properties. The achievement of Janus-like structures of metals (W-Mo, W-Cu, Ti-Ag, …), periodic multilayers or other original designs will be discussed. Finally, anisotropic behaviors in terms of optic, electronic and acoustic properties of these structured thin films will also be pointed out.

References

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