ABSTRACT

Geometrical Impact on the Physical Properties of Mesoscopic Scale Thick Material Thin Films

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A real material thin film never exhibits a perfect or ideal geometrical shape, regardless of the deposition process involved. This is mainly depicted by its unavoidable bulk usually represented by thickness ($d \neq 0$) and its surface irregularities commonly considered in term of rms-surface roughness ($\sigma \neq 0$) [1,2]. Being induced by the same deposition conditions, both film geometrical characteristics are in principle quite inseparable and closely interconnected. Their individual specific morphology and microstructure engender different material behavior under the same physical field (E) effect. Therefore, the resulting film's property (p) is consistently imputed to their combined contributions. The study of p evolution is commonly investigated through its dependence on d only as mainly encountered for macroscopic scale thick samples. However, configuration of real nano-films and nanostructured thin films is specific most of the time and then a strict separate control of their d or σ evolution can quickly become very delicate or quite impossible. Consequently, the study of their p evolution requires an adapted approach reflecting that specificity.

In the present work, our original proposal is provided which is illustrated by the study of nanostructured ferromagnetic nickel electrodeposits for which evolution of coercivity (Hc) and magnetic domain size (w) are precisely investigated. It is then clearly demonstrated that only a new film geometrical characteristic (τ) defined as $\tau = (d/\sigma)$ can consistently satisfy the announced objective [3].

[1] Q. Jiang, H.-N. Yang, G.-C. Wang, *Surface Science* 373, 181 (1997)
[2] G. Song, Y. Wang, D. Q. Tan, *IET Nanodielectrics* 5, 1 (2021)
[3] J. Ebothé, *J. Magn. and Magn. Materials* 494, 165764 (2020)