

Nano-patterning on Graphite by cobalt oxides

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Nano-patterning of graphite by metal particles based on their catalization of the gasification reaction of carbon is a well-known phenomenon studied since the 1960s [1,2]. This has seen a rising interest in recent times because of its promising applications in graphene cutting and nanolithography [3,4,5]. It has been shown that graphite nano-patterning can be done using different gases (H₂, O₂) and metallic particles (Ag, Pd, Ni, Co), but all of these experiments need heating of graphite/graphene to temperatures over 500°C in air or CVD reactors with a fairly high gas flow. In this work we report the formation of nano-channels by thermal oxidation of cobalt oxide, instead of metallic nanoparticles, at lower temperatures and oxygen pressure than in previous experiments. Due to the lack of studies of the growth of this material on graphite, we first present results on the characterization of the early, intermediate and final stages of this growth of cobalt oxide on Graphite at room temperature by XPS and AFM. Then, the results for different processes of further re-oxidation of the former cobalt oxide are presented. Finally, we have studied the nano-channels formed after the above processes by means of micro-Raman spectroscopy and AFM. The results reveal that the nanochannels consist of defective graphite. Also the formation of ripples on the non-covered graphite surface are observed.

References

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Figures

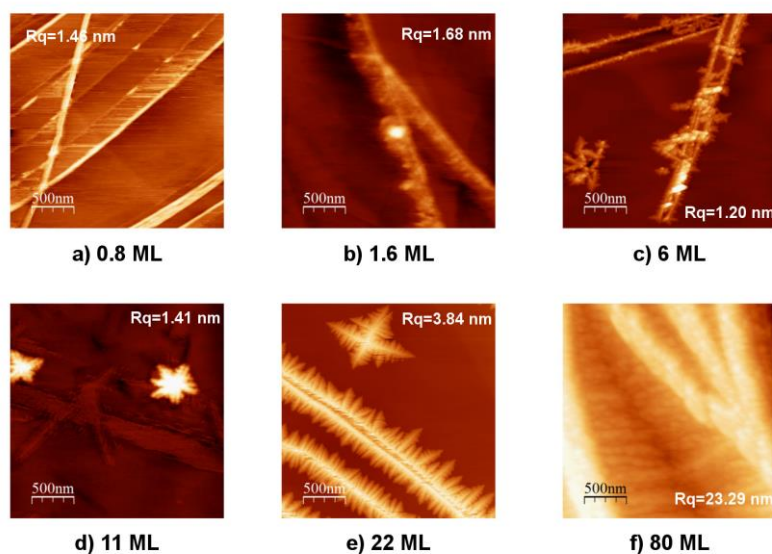


Fig. 1: CoO/HOPG, AFM images ($2.5 \times 2.5 \mu\text{m}$), coverage as labeled.

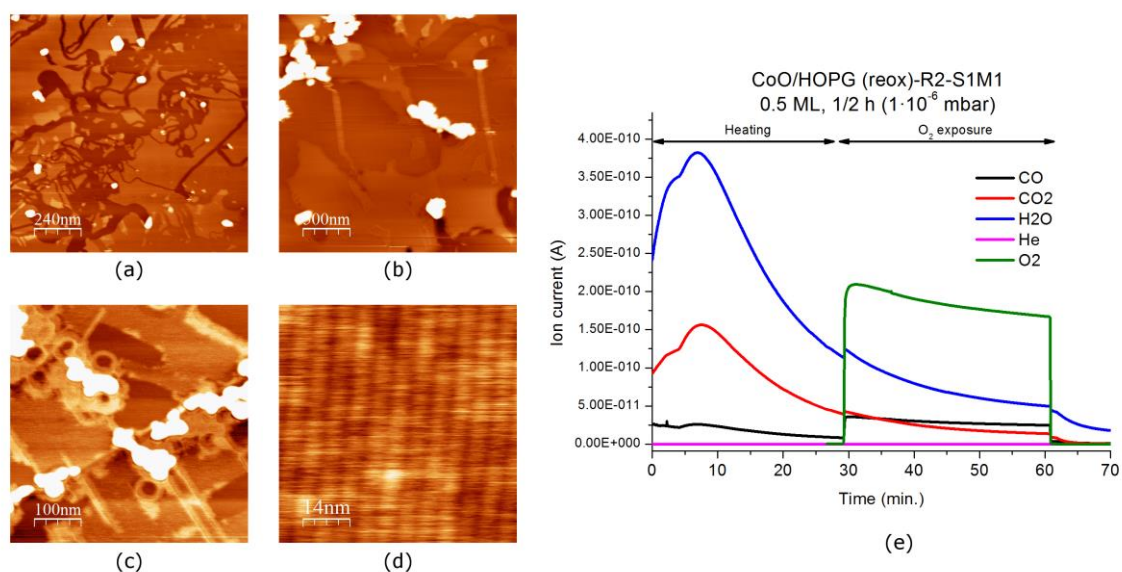


Fig. 2: (a)-(d): AFM images. (a) and (b): Nanochannels examples, CoO/HOPG, reoxidized, 400°C , 1 h, $2 \cdot 10^{-3}$ mbar. (a): 2 ML; (b) 4 ML. (c) and (d): examples of rippled zones. (e): QMS measurements during a reoxidation process