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Keeping metallic nanoclusters at the metallic surface

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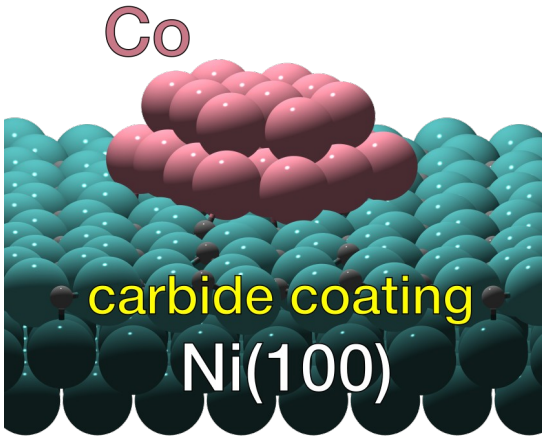
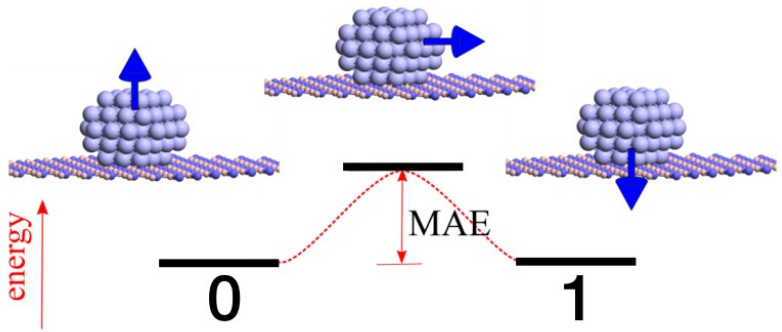
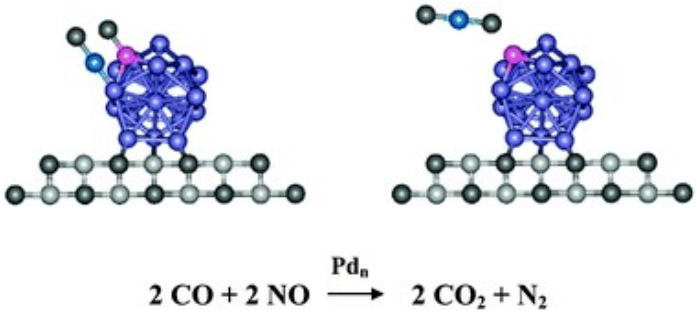


Technological importance of metallic nanoclusters

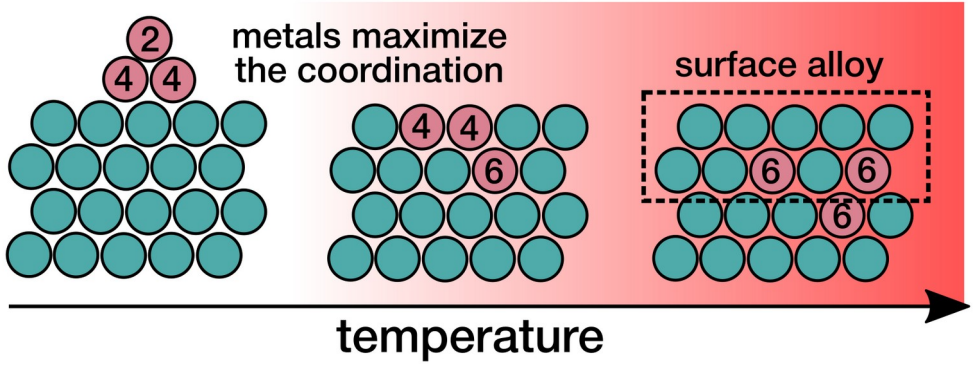
- **Magnetic memories** - magnetic anisotropy energy (MAE) blocks random flipping of metallic nanocluster's magnetic moment



- **Heterogeneous catalysis** - metallic nanoclusters are the most reactive sites on the surface

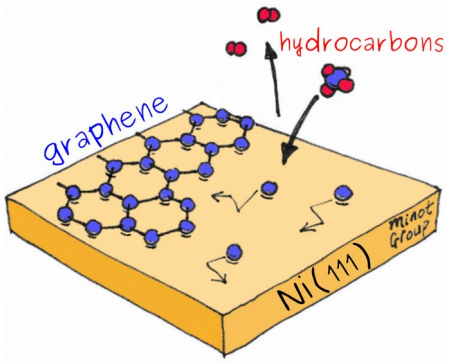


CLUSTER STABILITY is necessary for any application (but not sufficient!)



Carbide as an interproduct of graphene growth

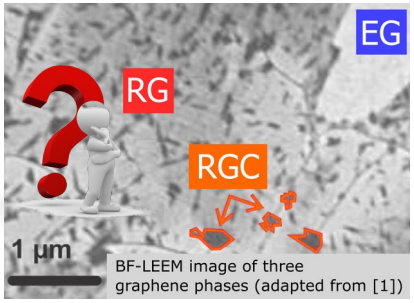
- **Graphene** is grown via chemical vapor deposition of hydrocarbons (e.g. C_2H_4) on metallic substrates



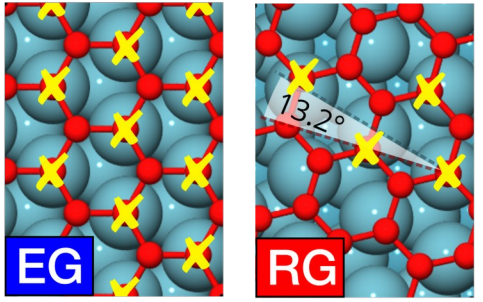
- **Nickel carbide** (Ni_2C) that appears on the surface is converted to graphene upon cooling

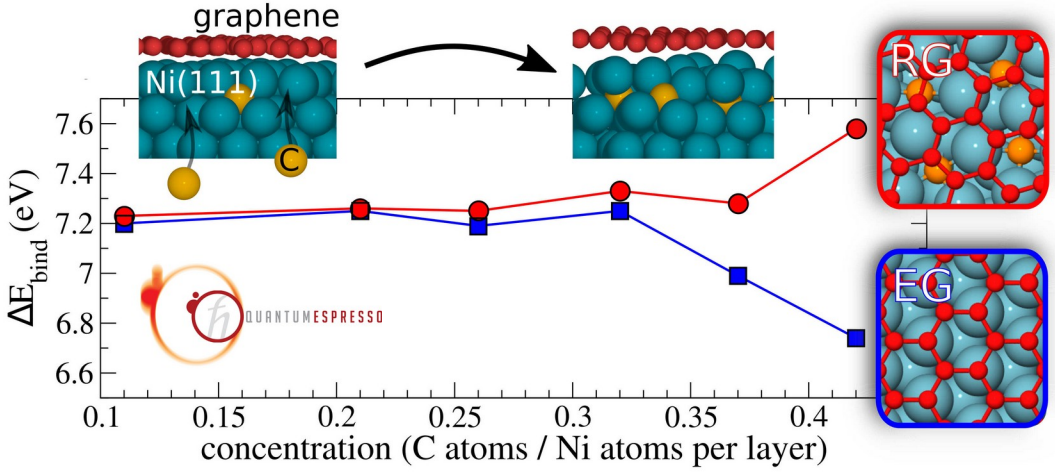
S. Stavrić, S. del Puppo, Ž. Šljivančanin, M. Peressi, *Phys. Rev. Materials* **5**, 014003 (2021)

- Ni_2C appears also after the graphene is grown - but only under the rotated graphene!

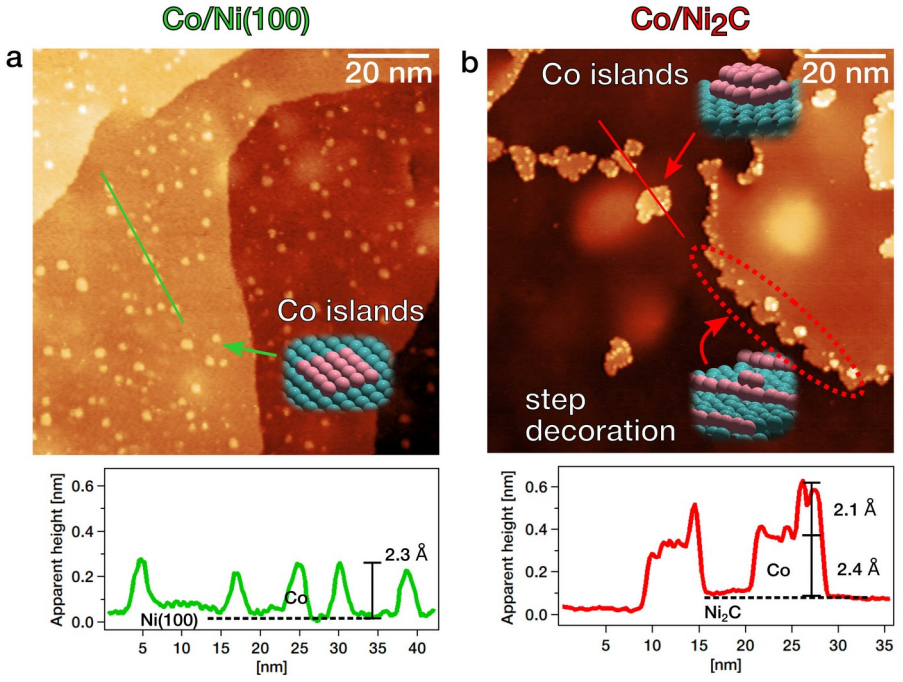


GRAPHENE **ROTATION UNLOCKS** THE SURFACE!



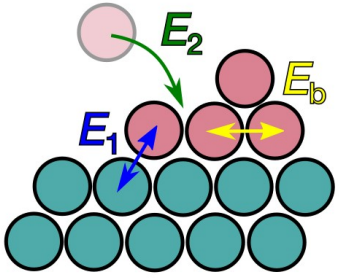


Carbide as an efficient coating

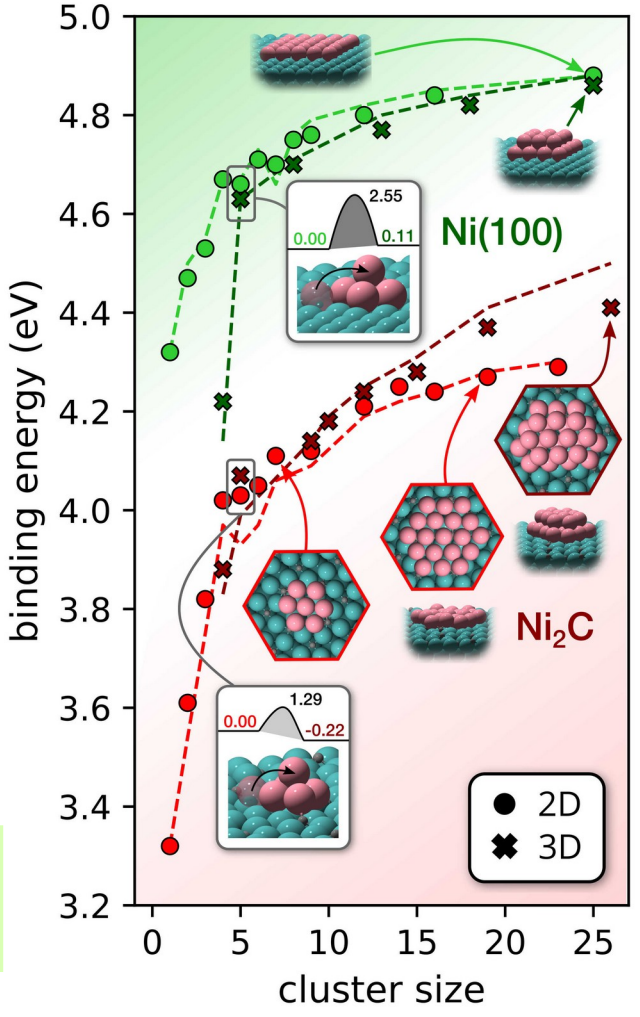


Simple model predicts the **growth mode** of Co clusters

- 2D on Ni(100)
- 3D on Ni_2C



$$E_{\text{bind}} = \frac{1}{n}(n_1 E_1 + n_2 E_2 + n_b E_b)$$



- higher Co mobility on Ni_2C
- Co dissolves on Ni(100) already at 200°C, on Ni_2C persists up to 300°C!

V. Chesnyak, S. Stavrić, M. Panighel, G. Comelli, M. Peressi, C. Africh, submitted to *Nanoscale* (2021)