ARTICLES

Journal of Semiconductors
(2020) 41, 082001
doi: 10.1088/1674-4926/41/8/082001

Controlled growth of Mo_2C pyramids on liquid Cu surface

Yixuan Fan[1], Le Huang[2], Dechao Geng[1, †], and Wenping Hu[1]

[1]Tianjin Key Laboratory of Molecular Optoelectronic Sciences, Department of Chemistry, School of Science, Tianjin University and Collaborative Innovation Center of Chemical Science and Engineering, Tianjin 300072, China

[2]School of Materials and Energy, Guangdong University of Technology, Guangzhou 510006, China

Abstract: Precise spatial control of 2D materials is the key capability of engineering their optical, electronic, and mechanical properties. However, growth of novel 2D Mo_2C on Cu surface by chemical vapor deposition method was revealed to be seed-induced 2D growth, limiting further synthesis of complex Mo_2C spatial structures. In this research, we demonstrate the controlled growth of Mo_2C pyramids with numerous morphologies, which are characterized with clear terraces within the structures. The whole evolution for Mo_2C pyramids in the coursed of CVD process has been detected, posing significant potential in probing growth mechanism. The formation of the Mo_2C pyramids arises from the supersaturation-induced nucleation and concentration-gradient driven diffused growth of a new Mo_2C layer on the edged areas of intrinsic ones, as supported by STEM imaging. This work provides a novel Mo_2C-based pyramid structure and further reveals a sliding growth mechanism, which could offer impetus for the design of new 3D spatial structures of Mo_2C and other 2D materials.

Key words: Mo_2C pyramids; liquid Cu; chemical vapor deposition

Citation: Y X Fan, L Huang, D C Geng, and W P Hu, Controlled growth of Mo_2C pyramids on liquid Cu surface[J]. *J. Semicond.*, 2020, 41(8), 082001. http://doi.org/10.1088/1674-4926/41/8/082001

Supporting Information

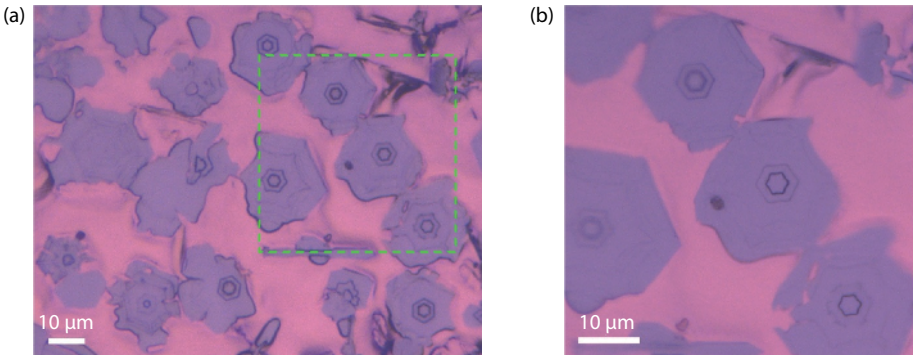

Fig. S1. (Color online) Optical images of large-area hexagonal pyramid Mo_2C structures on liquid Cu surface.

Correspondence to: D C Geng, gengdechao_1987@tju.edu.cn
Received 20 MAY 2020; Revised 26 MAY 2020.

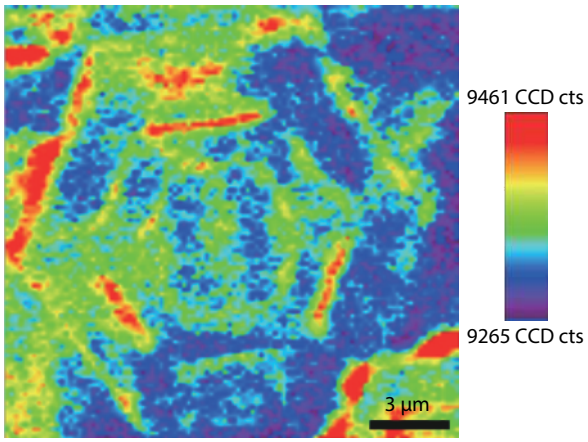

Fig. S2. (Color online) Raman mapping of Mo_2C pyramids structure.

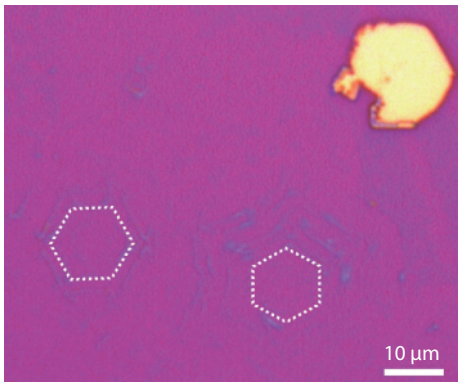

Fig. S3. (Color online) Optical image of left layered hexagonal profile after transferring process.

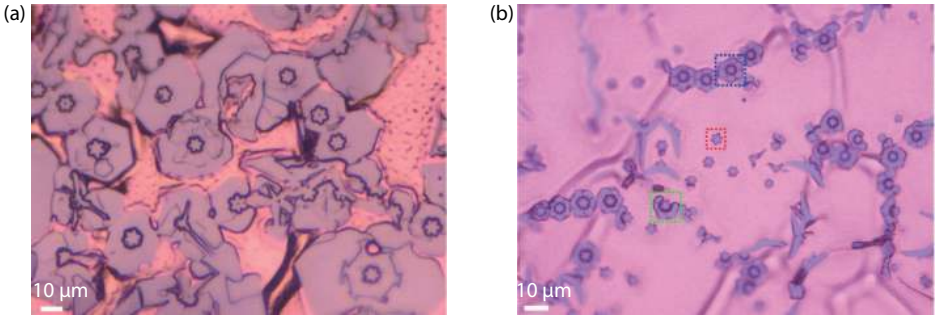

Fig. S4. (Color online) Direct observation of growth intermediates for layered Mo_2C pyramid structures.

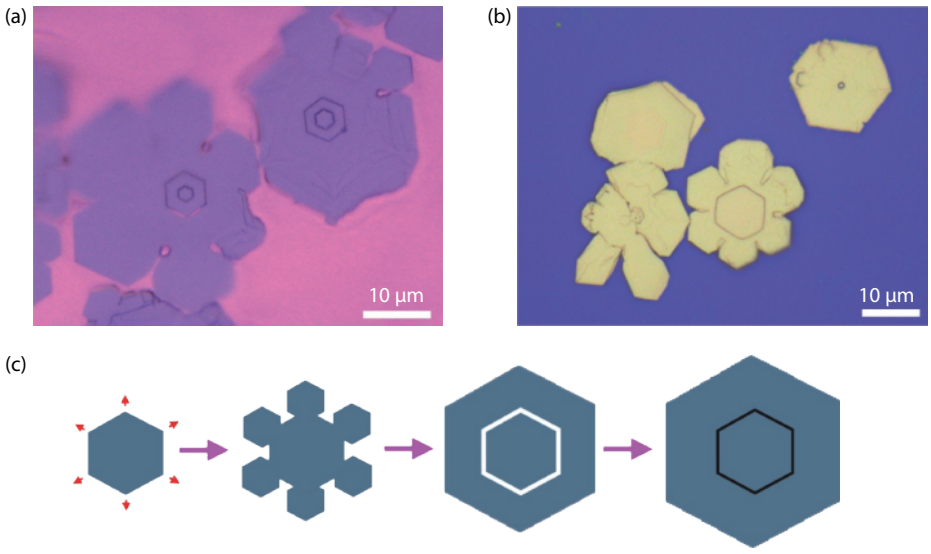

Fig. S5. (Color online) (a, b) Optical images of growth intermediates for hexagonal pyramid-like structures. (c) Schematic of the diagram illustrates the growth of hexagonal Mo_2C pyramid structures.