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Controlled formation of GeSi nanostructures on pillar-patterned Si substrate TONG ZHOU, Fudan University, CENG ZENG, Huazhong University of Science and Technology, YONGLIANG FAN, ZUIMIN JIANG, Fudan University, JINSONG XIA, Huazhong University of Science and Technology, ZHENYANG ZHONG, Fudan University, FUDAN UNIVERSITY TEAM, HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLABORATION — GeSi quantum nanostructures (QNs) have potential applications in optoelectronic devices due to their unique properties and compatibility with the sophisticated Si technology. However, the disadvantages of poor quantum efficiency of the GeSi QNs on flat Si (001) substrates hinder their optoelectronic applications. Today, numerous growth strategies have been proposed to control the formation of GeSi QNs in hope of improving the optoelectronic performances. One of the ways is to fabricate GeSi QNs on patterned substrates, where the GeSi QNs can be greatly manipulated in aspects of size, shape, composition, orientation and arrangement. Here, self-assembled GeSi QNs on periodic Si (001) sub-micro pillars (SPMs) are systematically studied. By controlling the growth conditions and the diameters of the SPMs, different GeSi QNs, including circularly arranged quantum dots (QDs), quantum rings (QRs), and quantum dot molecules (QDMs), are realized at the top edge of SMPs. Meanwhile, fourfold symmetric GeSi QDMs can be also obtained at the base edges of the SPMs. The promising features of self-assembled GeSi QNs are explained in terms of the surface chemical potential, which disclose the critical effect of surface morphology on the diffusion and the aggregation of Ge adatoms.

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