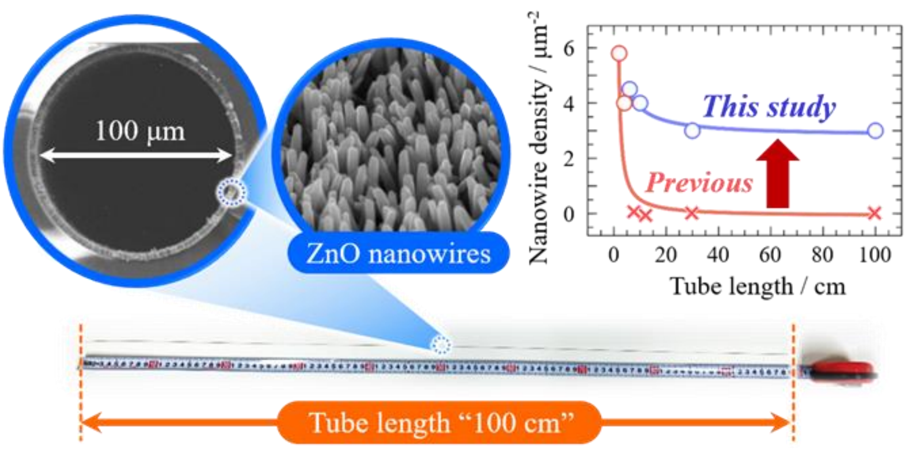
Rational Strategy for Space-Confined Seeded Growth of ZnO Nanowires in Meter-Long Microtubes

○ Ryoma Kamei[1], Takuro Hosomi[1,3], Eisuke Kanao[4,5], Masaki Kanai[1,2], Kazuki Nagashima[1,3], Tsunaki Takahashi[1,3], Guozhu Zhang[1], Takao Yasui[3,6], Jun Terao[1], Koji Otsuka[4], Takuya Kubo[4] and Takeshi Yanagida[1,2]

(1. Univ. of Tokyo, 2. Kyushu Univ., 3. (JST), PRESTO, 4. Kyoto Univ., 5.NIBIO, 6. Nagoya Univ.)

E-mail: kamei-ryoma696@g.ecc.u-tokyo.ac.jp

Seeded crystal growths of nanostructures within confined spaces offer an interesting approach to design chemical reaction spaces with tailored inner surface properties [1]. However, such crystal growth within confined spaces tends to be inherently difficult as the length increases due to confinement effects. In this study, we demonstrate a space-confined seeded growth of ZnO nanowires within meter-long microtubes of 100 μm inner diameter with the aspect ratio up to 10000, which had been unattainable to previous methods of seeded crystal growths. ZnO nanowires could be grown via seeded hydrothermal crystal growth for relatively short microtubes below the length of 40 mm, while any ZnO nanostructures were not observable at all for longer microtubes above 60 mm with the aspect ratio of 600. Microstructural and mass-spectrometric analysis revealed that a conventional seed layer formation using zinc acetate is unfeasible within the confined space of long microtubes due to the formation of detrimental residual Zn-complex compounds. To overcome this space-confined issue, a flow-assisted seed layer formation was developed. This flow-assisted method enables to grow spatially uniform ZnO nanowires via removing residual compounds even for 1m-long microtubes with the aspect ratio up to 10000.



Reference

[1] Wu et al., *Nanoscale*, **2018**, *10*, 17663.; Wind et al., *J. Phys. Chem. C*, **2019**, *123*, 7408.