Selective VOC Capture by ALD-Formed Molecular Imprinting

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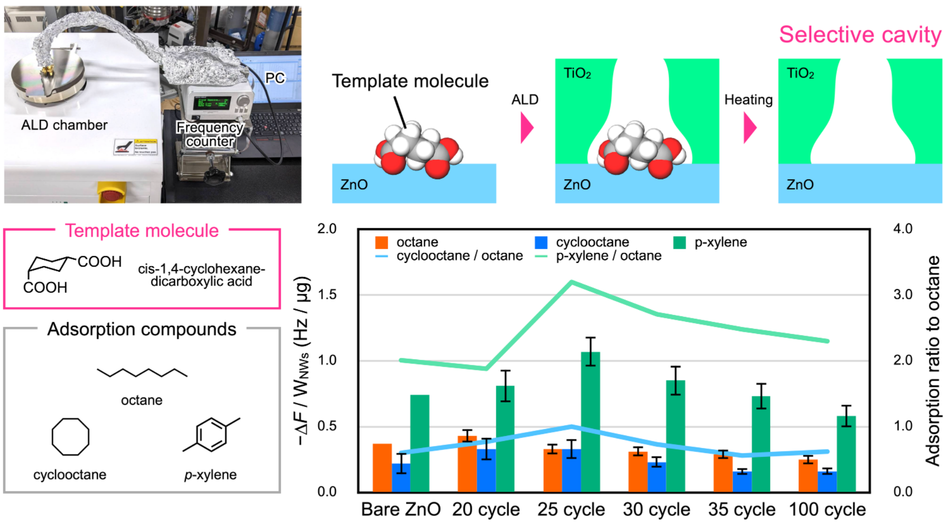
The detection of volatile organic compounds (VOCs) is expected to be applied in a wide range of fields. Although various VOC sensor materials have been developed, a sensor comparable to the sense of smell has not yet been put to practical use. In recent years, molecular imprinting technology, which can impart molecular selectivity to robust inorganic materials, has been attracting attention.[1–3] We have previously developed an apparatus that uses atomic layer deposition (ALD) to carry out the adsorption process of organic molecules and the subsequent deposition process of metal oxides in situ. By monitoring these processes using a quartz crystal microbalance (QCM), the deposition behavior of metal oxides in the presence of organic molecules was clarified.[4]

In this study, we investigated conditions such as molecular species and the concentration of template molecule and evaluated the adsorption amount of template before and after ALD using FT-IR. As a result, by using a molecular species that can withstand the ALD process and be desorbed after metal oxide deposition as a template, a space reflecting the shape of the target molecule was formed, enabling selective VOC capture. The results of the molecular adsorption evaluation suggested that not only the adhesion layer but also van der Waals interaction with the deposited layer may contribute to the increase in the adsorption amount.



1) C. P. Canlas *et al.*, *Nature Chem.* **2012**, *4*, 1030–1036. 2) P. Ruff *et al.*, *Microporous Mesoporous Mater.* **2016**, *235*, 160–169. 3) N. Sobel and C. Hess, *Angew. Chem. Int. Ed.* **2015**, *54*, 15014–15021. 4) H. Matsuo *et al.*, *ACS Appl. Nano Mater.* **2024**, *7*, 24498–24507.