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Molecular Viscosity Sensors with Two Rotators for Optimizing the Fluorescence Intensity-Contrast Trade-off


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Invited for the cover of this issue is the collaborative team of the groups of O-Pil Kwon at Ajou University, Chang-Lyoul Lee at Advanced Photonics Research Institute (APRI), Gwangju Institute of Science and Technology (GIST), Sehoon Kim at Korea Institute of Science and Technology (KIST), Hoseop Yun at Ajou University, and Sang Kyu Kwak at Ulsan National Institute of Science and Technology (UNIST). The image depicts fluorescent molecular rotors by introducing two rotational groups with high fluorescence contrast and cellular fluorescence imaging for mapping cellular viscosity. Read the full text of the article at 10.1002/chem.201704036.

What is the most significant result of this study?

The most significant result of this study is optimization of the fluorescence intensity-contrast trade-off of molecular viscosity sensors by introducing two rotators. Compared to controlled molecular rotors with a single rotator, these molecular rotors with two rotators show one order of magnitude higher quantum yield. Moreover, molecular rotors with two rotators exhibit very high fluorescence contrast, up to close to 40. With these optimal characteristics, we successfully demonstrate the mapping of intracellular viscosity, which visually discriminates organelles with high viscosity.

What future opportunities do you see (in the light of the results presented in this paper)?

The introduction of two rotators may allow us to make efficient molecular viscosity sensors with simultaneous high fluorescence contrast and high quantum yield (fluorescence intensity) in various viscous media. For viscosity sensors, the alkoxy group introduced in this work is of practical importance, owing to its strong electron-donating and highly viscosity-sensitive rotational abilities. We hope that this design strategy with two rotators would be helpful in developing highly efficient fluorescent molecular rotors.

How did each team member/collaborator contribute to the work?

The collaborative team was made up belonging to five research groups in four institutions. O-Pil Kwon's group (Ajou University) contributed design and synthesis of molecular rotors and investigation of photophysical properties. Chang-Lyoul Lee's group (Advanced Photonics Research Institute (APRI), Gwangju Institute of Science and Technology (GIST)) contributed the analysis of the fluorescent dynamics. Sehoon Kim's group (Korea Institute of Science and Technology (KIST)) provided the cellular fluorescence imaging. Hoseop Yun's group (Ajou University) contributed crystallographic analysis. Sang Kyu Kwak's group (Ulsan National Institute of Science and Technology (UNIST)) provided fruitful computational calculations.

COVER PROFILE

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Read more about the story behind the cover in the Cover Profile and about the research itself on page ■■ ff. (DOI: 10.1002/chem.201704036).