

# Heavy cyclobutadienes and heavy ketones

Prof. Tsukasa MATSUO

*Department of Applied Chemistry*, Faculty of Science and Engineering, Kindai University,  
3-4-1, Kowakae, Higashi-Osaka, Osaka 577-8502, Japan  
*e-mail*: t-matsuo@apch.kindai.ac.jp

In 2011, we reported the synthesis of the first cyclobutadiene (CBD) silicon analogue,  $\text{Si}_4(\text{EMind})_4$ , supported by the fused-ring bulky EMind groups (EMind = 1,1,7,7-tetraethyl-3,3,5,5-tetramethyl-*s*-hydrindacen-4-yl). The  $\text{Si}_4$  ring shows a planar rhombic charge-separated structure as a consequence of the polar Jahn-Teller (J-T) distortion to counteract the antiaromaticity with a cyclic  $4\pi$ -electron system. This result is in sharp contrast to the fact that the carbon CBDs are mainly stabilized by the covalent J-T distortion producing a rectangular-shaped  $\text{C}_4$  ring with two isolated C=C double bonds. In 2018, we reported the CBD germanium analogue,  $\text{Ge}_4(\text{EMind})_4$ , which can be obtained as room-temperature stable dark red crystals via the reaction of the 1,2-dichlorodigermene with lithium naphthalenide. The  $4\pi$ -electron antiaromaticity is also stabilized by the polar J-T distortion in the  $\text{Ge}_4$  ring producing a planar diamond-like charge-separated structure. The heavy ketones including a germanone,  $(\text{Eind})_2\text{Ge}=\text{O}$  (Eind = 1,1,3,3,5,5,7,7-octaethyl-*s*-hydrindacen-4-yl), with a planar tricoordinate Ge atom and a terminal oxygen atom will also be presented.