Construction of cyclobutane rings is an important objective due to their occurrence in many natural products and biologically active compounds and utilization in organic synthesis. Recently, we have reported intramolecular [2+2] and [4+2] cycloaddition reactions of ethenetricarboxylic acid 1,1-diester with cinnamylamines under the amide formation conditions in sequential processes [1]. In this work, intra- and intermolecular cycloaddition reactions of ethenetricarboxylates and styrenes have been investigated. While the reaction of (Z)-4-aryl-3-butenylamide of ethenetricarboxylate with 1-1.5 equiv. of Lewis acids such as SnCl₄ gave cis-fused cyclobutanes as major products, (E)-4-phenyl-3-butenylamide of ethenetricarboxylate with catalytic amounts of Lewis acids gave a trans-fused cyclobutane. Although [2+2] cycloadditions of electron-deficient alkenes and electron-rich alkenes were reported, the reaction with styrenes were relatively limited [2]. The reactions of ethenetricarboxylates and styrenes with 1 equiv. of SnCl₄ gave 1,3-cis-substituted cyclobutanes stereoselectively. The origin of observed selectivities has been examined by the DFT calculations.
