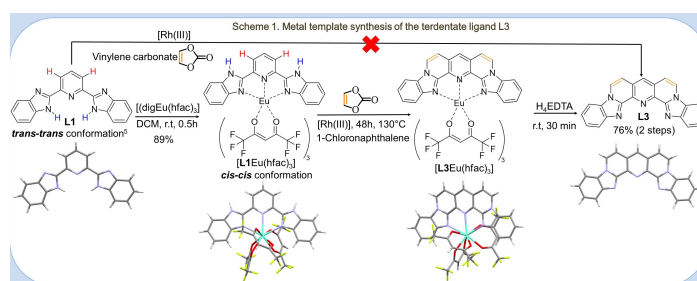


Metal Template Synthesis of Aromatic Preorganized Ligands for Tuning Stability Constants in Lanthanide Adducts

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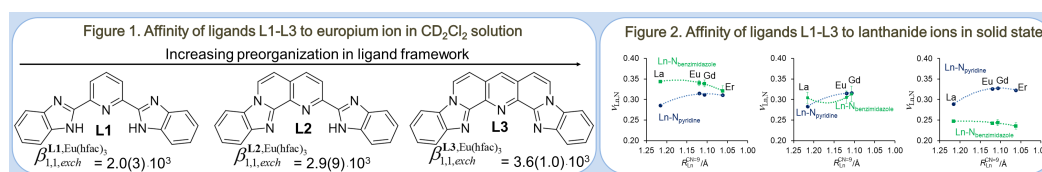
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Among the multifactorial parameters affecting the stability and geometry of complexes for a given metal, the structural conformation of ligands displays a crucial influence.¹ A ligand preorganized in an orientation close to the conformation required to complex a metal ion tends to result in increased affinity for the entering guest thanks to the removal of the conformational change energy produced upon complexation.² With this in mind, ligand **L3** was synthesized from **L1** via a metal template strategy,³ in which the *cis-cis* bound terdentate ligand in $[\mathbf{L1Eu}(\text{hfac})_3]$ undergoes intermolecular rhodium-catalyzed reactions aiming at intercalating a vinylene carbonate between the N-H groups of the benzimidazole side arms and the C-H units of the central pyridine ring.⁴ Comparing the affinity of ligands **L1**, **L2** and **L3** with trivalent lanthanides in both solution (NMR studies) and solid state (X-ray analysis) allowed to determine the relationship of the level of structural preorganization with complexes stability constants.



The *trans-trans* conformation in ligand **L1** leads to the failure of rhodium-catalyzed N-H/C-H activation reaction (red cross in Scheme 1) when **L1** is simply reacted with vinylene carbonate. In order to overcome this limitation, the complexation of **L1** to $[(\text{dig})\text{Eu}(\text{hfac})_3]$ have been considered for forcing the coordinated terdentate ligand **L1** to accommodate the unfavorable *cis-cis* orientation required for intermolecular rhodium-catalyzed reactions between vinylene carbonate and NH, CH of bound ligand **L1**. As expected, carrying out the rhodium-catalyzed annulation of $[\mathbf{L1Eu}(\text{hfac})_3]$ with vinylene carbonate, followed by demetallation with H₄EDTA, finally generates the target ligand **L3** in 76% yield.

Increasing the level of preorganization in ligand scaffold along the **L1**→**L2**→**L3** series gives rise to (i) improved binding constants with trivalent lanthanides in CD₂Cl₂ solution due to the removal of the energy cost for rotating the benzimidazole side arms to reach the high-energy *cis-cis* organization required for metal complexation reaction, and (ii) significant decreased Ln-N affinity in solid state due to a limited match between the lanthanide size and the larger cavity of the rigid terdentate ligand with 5-membered chelate rings.



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