

Lanthanide Luminescent Logic¹ – functional organic scaffolds and soft polymers gels as logic gate mimics

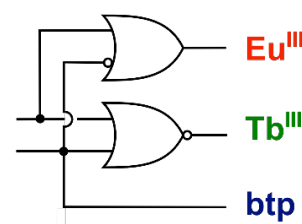
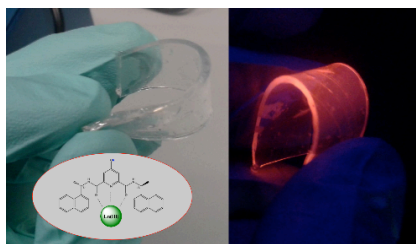


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Within the broad interests of supramolecular chemists, molecular logic² has received mixed attention. The logical analysis of dynamic and responsive chemical systems, however, forms a truly versatile approach to extract and process information simultaneously. From chemical inputs of system conditions to readable outputs in physical properties, simple 'computations' can be made. The language of modern logic, pioneered in Irish mathematics by George Boole, is a universal tool in analysis and parameterisation across the broadest spectrum of chemistries.

This talk will present a recent example¹ of an intrinsic chemical device formed as a soft material exhibiting logical outputs to chemical input.



Simple Eu^{III} and Tb^{III} complexes³ as encapsulated processors give strong output emission signals clear to both man and machine. Meeting the demands for basic application (materials platforms or advanced formulation)⁴ a facile functional material is described which, using low loading of specialist compound, is manufactured and readily-processed into devices capable of analyte reporting and environmental response. A logical analysis will be demonstrated of responses to parameterise the contained system as a Double-Input-Triple-Output logic gate mimic; the implications and potentials of these systems will be highlighted.

1. S. J. Bradberry, J. P. Byrne, C. P. McCoy and T. Gunnlaugsson, *Chem. Commun.*, 2015, **51**, 16565.
2. A. P. de Silva, *Molecular Logic-Based Computation*, Royal Society of Chemistry, Cambridge, 2013.
3. (a) S. J. Bradberry, A. J. Savyasachi, M. Martinez-Calvo and T. Gunnlaugsson, *Coord. Chem. Rev.*, 2014, **273–274**, 226; b) S. J. Bradberry, A. J. Savyasachi, R. D. Peacock and T. Gunnlaugsson, *Faraday Discuss.*, 2015, **185**, 413; c) J. P. Byrne, M. Martinez-Calvo, R. D. Peacock and T. Gunnlaugsson, *Chem. Eur. J.*, 2016, **22**, 486.
4. (a) C. P. McCoy, F. Stomeo, S. E. Plush and T. Gunnlaugsson, *Chem. Mater.*, 2006, **18**, 4336; b) K. Binnemans, *Chem. Rev.*, 2009, **109**, 4283. c) J. Andres, R. D. Hersch, J.-E. Moser and A.-S. Chauvin, *Adv. Funct. Mater.*, 2014, **24**, 5029.