Referências Bibliográficas

Referências Capitulo_1

[1] Quirino, W. et al. **Eu-β-diketonate complex OLED as UV portable dosimeter.** Synthetic Metals 161, p. 964-968, 2011.

[2] Blackburn, O. A., et al. ***N*-Aryl stilbazolium dyes as sensitizers for solar cells.** Dyes and Pigments 92, p. 766-777, 2012.

[3] Irimia-Vladu, M. et al. **Indigo - A Natural Pigment for High Performance Ambipolar Organic Field Effect Transistors and Circuits.** Advanced Materials 24, p. 375-380, 2012.

[4] Usman, M. et al. **In-plane polarization anisotropy of ground state optical intensity in InAs/GaAs quantum dots.** Journal of Applied Physic 110, p. 094512, 2011.

[5] Liu, X. et al. **Molecular Origins of Optoelectronic Properties in Coumarin Dyes: Toward Designer Solar Cell and Laser Applications.** Journal Physic Chemical A 116, p. 727-737, 2012.

[6] Yaacobi-Gross, N. et al. **Molecular control of quantum-dot internal electric field and its application to CdSe-based solar cells.** Nature Material 10, p. 974-979, 2011.

[7] http://www.oled-info.com/samsung-sold-over-2-million-galaxy-note-phones-plans-sell-10-million-2012.

[8] http://www.oled-info.com/lgs-31-oled-3d-tv-go-sale-march-2011-9000.

[9] Li, Z. et al. **A highly selective fluorescent chemosensor for Cd(II) based on 8-hydroxyquinoline platform.** Inorganic Chemistry Communications 14, p. 1241-1244, 2011.

[10] Zhou, C. et al. **Theoretical investigation on quinoline-based platinum (II) complexes as efficient singlet oxygen photosensitizers in photodynamic therapy.** Journal of Organometallic Chemistry 696, p. 3322-3327, 2011.

[11] Blyth, R. I. R. et al. **Characterisation of thin films of the organic infra-red emitters Yb- and Er-tris(8-hydroxyquinoline) by X-ray photoemission spectroscopy.** Sythetic Metals 139, p. 207-213, 2003.

[12] Khreis O. M. et al. **Infrared organic light emitting diodes using neodymium *tris*-(8-hydroxyquinoline).** Journal Applied Physic 88, p. 777, 2000.

[13] Kepler R. G. et al. **Electron and hole mobility in *tris*(8-hydroxyquinolinolato-N1,O8) aluminum.** Applied Physic Letter 66, p. 3618, 1995.

[14] Pope, M., Kallmann, H. P., Magnantte, P. **Electroluminescence in Organic Crystals.** Journal of Chemical Physics 38, p. 2042-2043, 1963.

[15] Helfrich, W.; Schneider, W. **Recombination Radiation in Anthracene Crystals.** Physical Review Letters 14, p. 229-231, 1965.

[16] Chiang, C. K. et al., **Electrical Conductivity in Doped Polyacetylene.** Physical Review Letters 39, p. 1098-1101, 1977.

[17] Tang, C. W., Van Slyke S. A. **Organic Electroluminescent Diodes.** Applied Physics Letters 51, p. 913-915, 1987.

[18] Burroughes, J. H. et al. **Ligth-emitting diodes based on conjugated polymers.** Nature. 347, p. 539-541, 1990.

[19] Thompson, J. et al. **Obtaining Characteristic 4f–4f Luminescence from Rare Earth Organic Chelates.** Advanced Functional Materials 14, p. 979-984, 2004.

Referências capitulo_2

[1] Pavia, D. L. et al. **Introdução à espectroscopia 4.** 2010.

[2] Skoog, D. A.; Leary, J. J. **Principles of Instrumental Analysis 4.** Bookman, 1992.

[3] Quirino, W. G. Tese de Doutorado, PUC-Rio, 2007.

[4] Mueller, G. Electroluminescence I, Semiconductor and Semimetals 64, Acad. Press, 2000.

[5] Baldo, M. A.; Thompson M. E.; Forrest S. R. **Phosphorescent materials for application to organic light emitting devices.** Pure and Applied Chemistry 71**,** p. 2095-2105, 1999.

[6] Tsuboi, T. **Electronic states of phosphorescent molecules Ir(ppy)$_3$ and PtOEP used in organic light emitting diodes.** Journal of Luminescence 119, p. 288-292, 2006.

[7] Teixeira, K. Dissertação de Mestrado, PUC-Rio, 2010.

[8] Stafstrom, S. et al. **Polaron lattice in highly conducting polyaniline: Theoretical and optical studies.** Physical Rewiew Letters. 59, p. 1464-1467, 1987.

[9] Rezende, S. A. Física de materiais e dispositivos eletrônicos Edit. UFPR, 1996.

[10] Paredes, Y. Tese de doutorado, PUC-Rio, 2012.

[11] Arkhipov, V. I. et al. **Charge injection into light-emitting diodes: Theory and experiment.** Journal of Applied Physics 84, p. 848-856, 1998.

[12] Franky, S. Organic Electronics Materials Processing Devices and Appliations, 2010.

[13] http://ceot.ualg.pt/OptoEl/theory/2terminal/

[14] Lessman, R. Dissertação de Mestrado, Curitiba, 2005.

[15] Lampert, M.A.; Mark, P. **Current injection in solids**, 1970.

[16] Burrows, P. E., et al. **Relationship between electroluminescence and current transport in organic heterojunction light-emitting devices.** Journal of Applied Physics. 79, p. 7991-8006, (1996).

[17] kiy, M. **Observation of the Mott–Gurney law in tris (8-hydroxyquinoline) aluminum films.** Applied Physics Letters 80, p. 1198-1200, 2002.

[18] Ono, Y. A.; Electroluminescent Displays, World Scientific: Singapore, 1995.

[19] http://www.rpi.edu/~schubert/Light-Emitting-Diodes-dotorg/chap10/F10, 2004

Referências capitulo_3

[1] Basset, H. et al. **Nomenclature of Inorganic Chemistry.** Journal of the Americam Chemical Society 82, p. 5523-5544, 1960.

[2] Judd, B.R. **Optical Absorption Intensities of Rare-Earth Ions.** Physical Review 127, p. 750-761, 1962.

[3] Adachi, G. In Rare Earths—Their Properties and Applications 1, p. 173, 1980.

[4] Hoshina, T. Luminescence of Rare Earth Ions, Sony Research Center Rep. 1983.

[5] Ofelt, G. S. **Structure of the f^6 Configuration with Application to Rare-Earth Ions.** The Journal of Chemical Physics *38*, p. 2171-2180, 1963.

[6] Dieke G. H. Spectra and Energy Levels of Rare Earth Ions In Crystals, p. 7 1972.

[7] Carnall, W. T. et al. *A Systematic Analysis of the Spectra of the Lanthanides Doped into Single Crystal LaF_3*, Argonne National Laboratory, Report, ANL 88/8 1988.

[8] Whan, R.E.; and Crosby, G. A. **Luminescence studies of rare earth complexes: Benzoylacetonate and dibenzoylmethide chelates.** Journal of Molecular Spectroscopy 8, p. 315-327, 1962.

[9] Santos, G. et al. **Organic light emitting diodes with europium (III) emissive layers based on β-diketonate complexes: The influence of the central ligand.** Journal of Non-Crystaline Solids 354, p. 2897-2900, 2008.

[10] Chen, Z.; Peng, M. Chemical Research in Chinese Universities 25, p. 796, 2009.

[11] Höller, C. J. et al. **The interaction of rare earth chlorides with 4,4′-bipyridine for the reversible formation of template based luminescent Ln-N-MOFs.** Dalton Transactions 39, p. 461-468, 2010.

[12] Fang, J. et al. **Ligand effect on the performance of organic light-emitting diodes based on europium complexes.** Journal Luminescence 124, p. 157-161, 2007.

[13] Bünzli, G., **Benefiting from the Unique Properties of Lanthanide Ions** Accounts of Chemical Research 39, p. 53-61, 2006.

[14] Eliseeva, S. et al. **Electroluminescent properties of the mixed-ligand complex of terbium salicylate with triphenylphosphine oxide.** Synthetic Metal 141, p. 225-230, 2004.

[15] Albert, A.; Magrath, D. **The choice of a chelating agent for inactivating trace metals: II. Derivatives of oxine (8-hydroxyquinoline).** Biochemical Journal 41, p. 534-545, 1947.

[16] Berg, R., Z. Analytical Chemistry 71, p. 361, 1927.

[17] Phillips, J. P. **The Reactions Of 8-Quinolinol.** Chemical Review 56, p. 271-297, 1956.

[18] Rane, A. T., *Journal of Scientific & Industrial Research* 43, p. 261, 1984.

[19]Czugl, M.; Neumann, R.; Weber, E. **X-ray crystal structures and data bank analysis of Zn(II) and Cd(II) complexes of 2- and 7-nonyl substituted 8-hydroxyquinoline and 8-hydroxyquinaldine extractive agents.** *Inorganica Chimica Acta* 313, p.100-108, 2001.

[20] King, E.J., Biochemistry 31, p.2046,(1937).

[21] Pirtea, Th.I., Z. Analytical Chemestry 107, p.191, (1936).

[22] Tang, C. W.; Vanslyke, S. A. **Organic electroluminescent diodes.** Applied Physics Letters 51, p. 913-915, 1987.

[23] VanSlyke, S. A.; Chen, C. H.; Tang, C. W. **Organic electroluminescent devices with improved stability.** Applied Physics Letters 69, p. 2160-2162, 1996.

[24] Stakhira, P. Y.; Cherpak, V. V. **The properties of heterojunction based on CuI/pentacene/Al.** Vacuum 83, p.1129-1131, 2009.

[25] Gillin, W. **Erbium (III) tris(8-hydroxyquinoline) (ErQ): A potential material for silicon compatible 1.5 µm emitters** Applied Physics Letters 74, p. 798-799, 1999.

[26] Khreis, O. et al. **Infrared organic light emitting diodes using neodymium *tris*-(8-hydroxyquinoline).** Journal of Applied Physics 88, p. 777-800, 2000.

[27] Kawamura, Y. **Observation of neodymium electroluminescence.** Applied Physics Letters 74, p. 3245-3247, 1999.

[28] Khreis, O. et al. **980 nm electroluminescence from ytterbium *tris* (8-hydroxyquinoline)**. Organic Electronics 2, p. 45-51, 2001.

[29] Van Deun, R. et al. **Rare-Earth Quinolinates: Infrared-Emitting Molecular Materials with a Rich Structural Chemistry.** Inorganic Chemistry 43, p. 8461-8469, 2004.

[30] Curioni, A.; Andreoni, W. J. **Metal−Alq_3 Complexes: The Nature of the Chemical Bonding.** Journal of the American Chemical Society 121, p. 8216-8220, 1999.

[31] Rajeswaran, M.; Blanton, T. N.; Klubek, K. P. *Z.Kristallogr. NCS* 218: 439.

[32] http://en.wikipedia.org/wiki/Tris(8-hydroxyquinolinato)aluminium

[33] Thangaraju, K. et al. **Study on photoluminescence from tris-(8-hydroxyquinoline)aluminum thin films and influence of light.** Appl. Phys. Lett. 89, p. 082106-082108, 2006.

[34] Curioni, A. et al. **Alq_3: ab initio calculations of its structural and electronic properties in neutral and charged states.** Chemical Physics Letters 294, p.263-271, 1998.

[35] Hamata, Y. **The development of chelate metal complexes as an organic electroluminescent material.** IEEE Transactions on electron devices 44, p.1208-1217, 1997.

[36] Higginson, K. A.; Zhang, X. M.; Papadimitrakopoulos, F. **Thermal and Morphological Effects on the Hydrolytic Stability of Aluminum Tris(8-hydroxyquinoline) (Alq_3).** Chemistry of Materials 10, p.1017-1020, 1998.

[37] Ravi Kishore, V. V. et al. **On the assignment of the absorption bands in the optical spectrum of Alq_3.** Synthetic Metals 126, p.199-205, 2002.

[38] Johansson, N. et al. Chemical Physics 11, p. 2157, 1999.

[39] Liu, Z. et al. **Efficient multilayer organic light emitting diode.** Synthetic Metals 122, p.177-179, 2001.

[40] Miyata, S.; Singh, H. **Organic Electroluminescent Materials and Devices.** Gordon and Breach, 1997.

[41] Mech, A. et al. **The luminescence properties of three tetrakis dibenzoylmethane europium(III) complexes with different counter ions.** Journal of Alloys and Compounds 451**,** p. 215-219, 2008.

[42] Quirino, W.G. *et al.* **Electroluminescent devices based on rare-earth tetrakis β-diketonate complexes.**Thin Solid Films 517, p.1096-1100, 2008.

[43] http://www.inovacaotecnologica.com.br/noticias/noticia.php

[44] Niyama, E. Dissertação de Mestrado, Universidade de São Paulo USP, São Paulo, 2004.

[45] Binnemans, K. **Lanthanide-Based Luminescent Hybrid Material.** Chemical Reviews 109, p. 4283-4374, 2009.

[46] Ballardini, R. et al. **Phosphorescent 8-quinolinol metal chelates. Excited-state properties and redox behavior.** Inorganic Chemistry 25, p. 3858-3865, 1986.

Referências Capitulo_4

[1] Qiu, C. et al. **Efficient blue-to-violet organic light-emitting diodes**. Synthetic Metals 140, p. 101-104, 2004.

[2] Yang, S. et al. **Impact of electric fields on the emission from organic light-emitting diodes based on polyvinylcarbazole (PVK).** Journal of Luminescence 122, p. 614-616, 2007.

[3] Ohring, M., **The Materials Science of Thin Films.** Academic Press, San Diego 1991.

[4] Chambers, A.; Fitch, R.K.; Halliday, B.S. Basic Vacuum Technology (Adam Hilger, Bristol, 1991.

[5] Legnani, C. Tese de doutorado, Departamento de Física, PUC-Rio, 2006.

[6] www.Intl-Light.com 2003.

[7] Tang, C.W.; VanSlyke, S. A. **Organic electroluminescent diodes.** Applied Physics Letters 5, p. 913-915, 1987.

[8] Reyes, R. G. Tese de doutorado, Departamento de Física, PUC-Rio, 2004.

[9] Welber, Q. Tese de Doutorado, Departamento de Física, PUC-Rio, 2007.

Referências capitulo_5

[1] Baldo, M. A.; Soos, Z. G.; Forrest, S.R. **Local order in amorphous organic molecular thin films**, Chemical Physic Letters 347, p. 297-303, 2001.

[2] Garbuzov, D. Z. et al. **Photoluminescence efficiency and absorption of aluminum-tris-quinolate (Alq_3) thin films.** Chemical Physics Letters 249, p. 433-437, 1996.

[3] Perkampus, H. H.; Kortum, K. **Über die Elektronenanregungsspektren einiger Metall-8-hydroxy-chinolinate,-4-hydroxy-acridinate und 4-hydroxyphenazinate** Fresenius Journal of Analytical Chemistry 190, p.111-126, 1962.

[4] Bulovic, V. et al. Organic Electronic Materials, Berlin, 2001.

[5] Aziz, A.; Narasimhan, K. L. **Subband gap optical absorption and defects in Tris(8 hydroxy quinolato) aluminium.** Synthetic Metals 131, p. 71-77, 2002.

[6] Martin R. L. et al. **ubband gap optical absorption and defects in Tris(8 hydroxy quinolato) aluminium.** Physic Review B 61, p. 15804-15811, 2000.

[7] Burrows H.D., fernanddes M., De Melo J. S., Monkman A.P., Navaratnam S., J. Am. Chem. Soc. 125, p.15310, (2003).

[8] Jayanthi, S. S.; Ramamurthy, P. **Excited Singlet State Reactions of Thiopyrylium with Electron Donors: Electron Transfer, Induction of Triplet by Internal and External Heavy Atom Effect, and Comparison of Pyrylium and Thiopyrylium Reactions.** The Journal of physical Chemistry A 102, p. 511-518, 1998.

[9] Ballardini, R. et al. **Phosphorescent 8-quinolinol metal chelates. Excited-state properties and redox behavior.** Inorganic Chemistry 25, p. 3858-3865, 1986.

[10] McGlynn, S. P.; Azumi, T.; Kinoshita, M. **Molecular spectroscopy of the Triplet State.** PrenticeHall, New York, 1969.

[11] Baldo M.A., Forrest S. R., **Transient analysis of organic electrophosphorescence: I. Transient analysis of triplet energy transfer.** Physic Review B 62, p. 10958-10966, 2000.

[12] Kunkely, H. et al. **Photoluminescence of 8quinolinolato(trioxo)rhenium(VII).** Inorganic Chemistry Communications 3, p. 645-647, 2000.

[13] Simon, C. **Lanthanide and Actinide chemistry**, Jhon Wiley & Sons, great Britain, 2006.

[14] Bunzli, J. C.; Chopin, G. R. **Lanthanide Probes in life, Chemical and earth scientes-Theory and Practice**, Elsevier, Amsterdam, 1989.

[15] Chen, C.H.; Jianmin, S. **Metal chelates as emitting materials for organic electroluminescence.** coordination Chemical Reviews 171, p 161-174, 1998.

[16] Bhatnagar, D. C.; Forster, L. S. **The luminescence of oxines and metal oxinates.** Spectrochimica Acta 21, p. 1803-1807, 1965.

[17] Kiy, M. et al. **The luminescence of oxines and metal oxinates.** Applied Physics Letters 80, p.1198-1200, 2002.

[18] Kepler R.G., et al. **Electron and hole mobility in *tris*(8-hydroxyquinolinolato-N1,O8) aluminum.** Applied Physics Letters 66, p. 3618-3620, 1995.

[19] Hung, L. S.; Tang, C. W.; Mason, M. G. **Enhanced electron injection in organic electroluminescence devices using an Al/LiF electrode.** Applied Physics Letters 70, p.152-154, 1997.

[20] Chen, B.J.; Sun, X. W.; Li, Y. K. **Influences of central metal ions on the electroluminescene and transport properties of tris-(8-hydroxyquinoline) metal chelates.** Applied Physics Letters 82, p. 3017-3019, 2003.

Apêndice I

Síntese dos complexos tetrakis 8-hidroxiquinolina de TR^{3+}

Os complexos tetrakis 8-hidroxiquinolina de TR^{3+} foram sintetizados ajustando-se o tipo de solvente, às concentrações e às misturas estequiométricas. Inicialmente, se dissolve 5mmol de 8-hidroxiquinolina em 20 mL de etanol a 95%. Essa solução foi neutralizada com 10 mL de uma solução aquosa contendo 5 mmol de hidróxido de contra cátion já seja (lítio Li^+, sódio Na^+ ou Potassio K^+). Em seguida foi adicionado à mistura resultante, sob agitação e sem aquecimento, 10 mL de uma solução contendo 1 mmol de $TR^{3+}Cl_3$ (TR^{3+} = La^{3+}, Y^{3+} ou Lu^{3+}) em etanol 95%. A mistura reacional foi mantida sob agitação por 24 horas à temperatura ambiente. O complexo precipitou-se na forma de um sólido amarelo, o qual foi filtrado e lavado com 5 porções de 20 mL de etanol a 95% e, posteriormente, secado no vácuo.

Análise Elementar dos Sais de Lítio

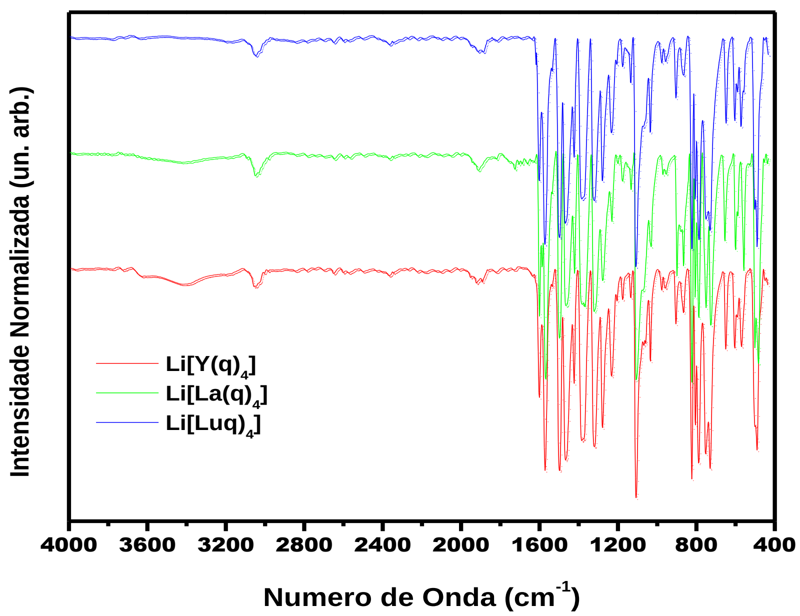
A análise elementar de carbono, hidrogênio e nitrogênio dos complexos de sais de Li (Tabela 1) mostra concordância com a fórmula geral $M[TR(q)_4]$, onde o TR = La^{3+}, Y^{3+} e Lu^{3+}; e o contra-cátion (M^+) representa o íon metálico alcalino Li+. A pequena diferença entre os valores calculados e os experimentais das percentagens de C, H e N permite inferir que os complexos tetrakis apresentam moléculas de H_2O e que foram preparados de modo eficiente com base no método de síntese utilizado.

Tabela I Análise elementar de carbono, hidrogênio e nitrogênio dos complexos $Li[TR(q)_4]$.

	%C		%H		%N	
	Calculado	Experimental	Calculado	Experimental	Calculado	Experimental
$Li[La(q)_4]$	59,85	60,59	3,35	3,58	7,76	8,22
$Li[Y(q)_4]$	64,30	63,69	3,60	3,76	8,33	8,69
$Li[Lu(q)_4]$	57,00	56,98	3,19	3,52	7,39	7,41

Apêndice II

Medidas de FTIR em pó.



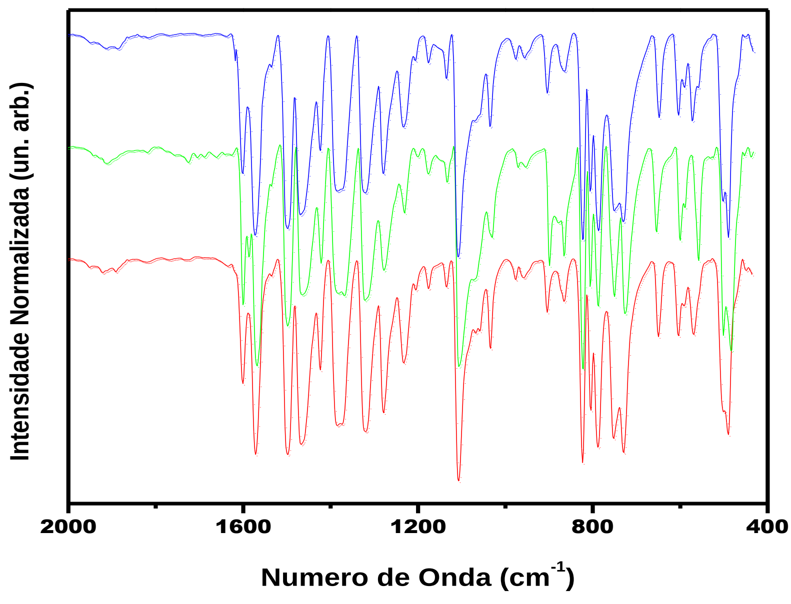


Figura II Espectro de absorção no infravermelho dos complexos Li[TR(q)$_4$]

Tabela II. Valores de frequência e modos vibracionais medidos por FTIR

Li[La(q)$_4$]	**Li[Y(q)$_4$]**	**Li[Lu(q)$_4$]**	**Tipo de Vibração**
1603	1602	1601	C=C estiramento do anel
1376	1382	1382	C-H Dobramento e estiramento
1322	1318	1323	C-H dobramento e estiramento
1275	1280	1280	C-H dobramento
1227	1232	1232	C-N estiramento e C-H dobramento
1104	1104	1104	C-O estiramento e C-H dobramento
823	823	823	C-H dobramento

Apêndice III

Os desenhos têm escala de mm

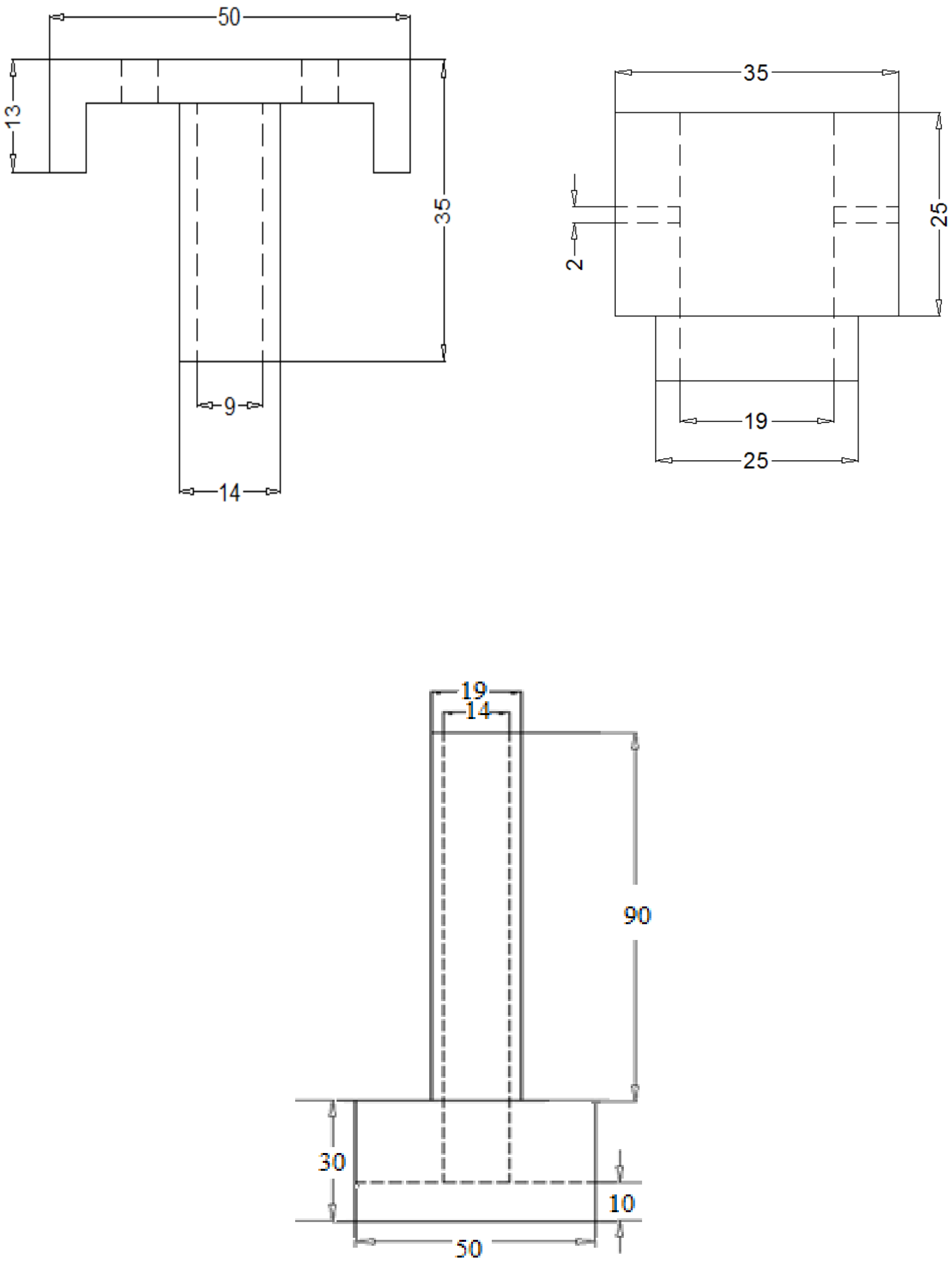


Figura IV Desenhos de peças utilizadas para medir EL

Apêndice IV

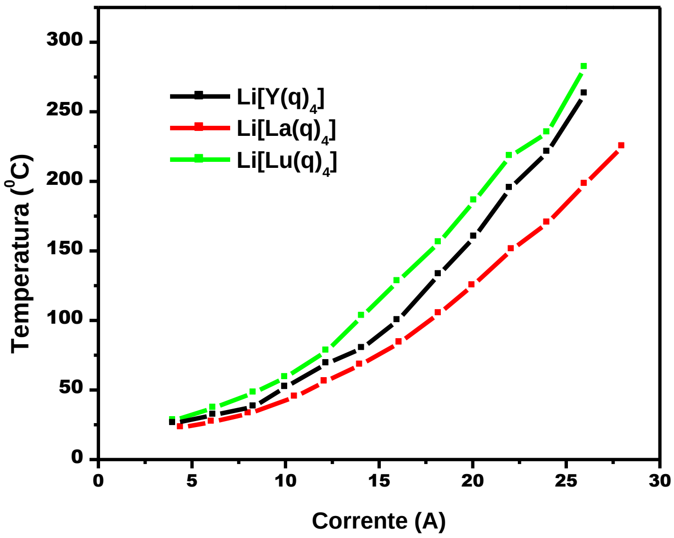


Figura IV Temperatura do cadinho versus corrente aplicada

Apêndice V

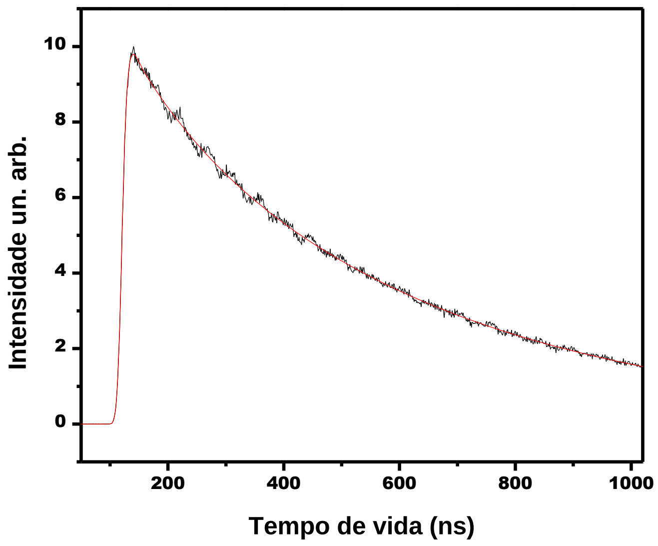


Figura V-1 Curva de decaimento luminescente do Alq_3 – λ_{em}=512nm e λ_{ex}=372nm

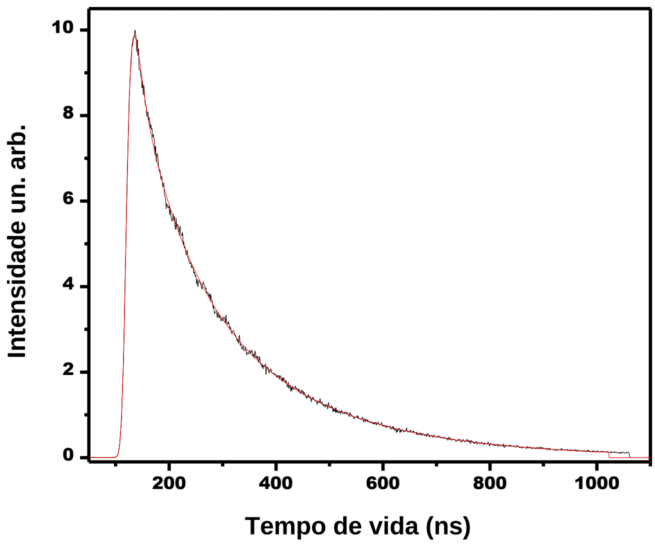


Figura V-2 Curva de decaimento luminescente do $Li[Y(q)_4]$ – λ_{em}=491nm e λ_{ex}=372nm

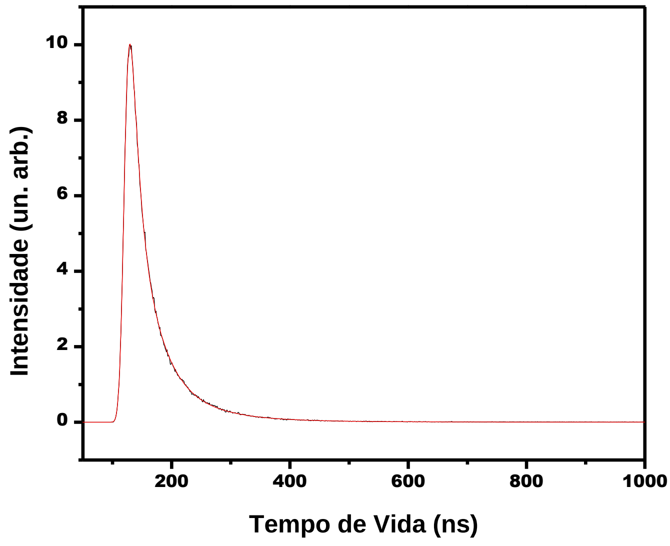


Figura V-3 Curva de decaimento luminescente do Li[La(q)$_4$] – λ_{em}=484nm e λ_{ex}=372nm

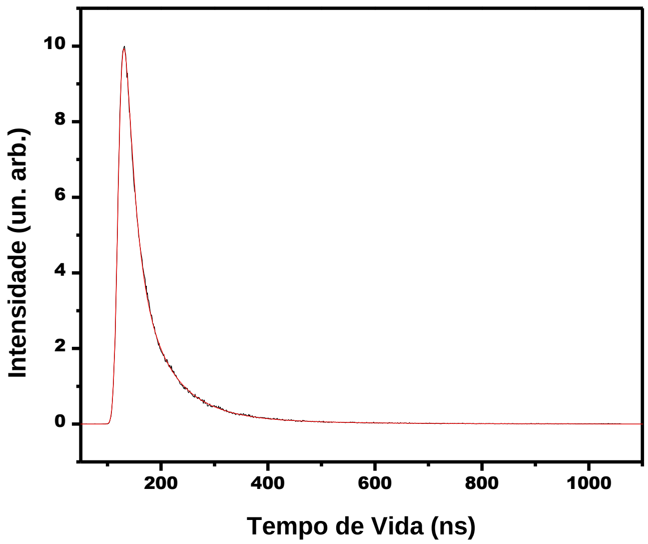


Figura V-4 Curva de decaimento luminescente do Li[Lu(q)$_4$] – λ_{em}=510nm e λ_{ex}=372nm