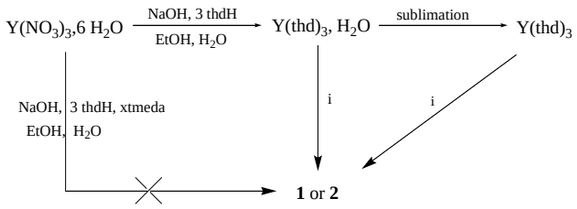
# NEW YTTRIUM PRECURSORS FOR YBCO FILMS PREPARED BY PI-MOCVD

J. Terrematte[a], S. Daniele[a], L.G. Hubert-Pfalzgraf[a], J. M. Decams[b], S. Le Gall[b], H. Guillon[b], S. Beauquis[c], P.H. Ng[c], C. Jimenez[c], F.Weiss[c]

a Université Claude Bernard Lyon 1, IRC, 2 avenue A. Einstein, 69626 Villeurbanne, Cedex, France
b JIPELEC , Chemin du Vieux Chêne, 38240 Meylan , France
c LMGP-ENSPG, St Martin d'Hères, France.

Metal β-diketonates $M(thd)_x$ (thd = 2,2,6,6-tetramethyl-3,5 heptanedionate) are commonly used as precursors for $YBa_2Cu_3O_7$ (YBCO) films in MOCVD technologies. Yttrium and barium β-diketonates are moisture sensitive and need to be handled with cares. This instability is a limiting factor for the industrial production of YBCO by MOCVD, provoking irreproducibility. This problem can be alleviated by the use of Lewis bases saturating the metal coordination sphere [1,2].

$Y(thd)_3$(TMEDA) **(1)** and $[Y(thd)_3]_2$(TMEDA) **(2)** compounds are prepared in high yields (80%) by mixing $Y(thd)_3(H_2O)$ or $Y(thd)_3$ and $Me_2NC_2H_4NMe_2$ (in appropriate stoichiometries) in hexane at room temperature (scheme 1). The one pot synthesis from $Y(NO_3),6\ H_2O$ is unsucessful due to sodium contamination.




**Scheme1** : Syntheses of compound **1** and **2**. *conditions and reagents : i; hexane, x tmeda, 20°C.*

The formation of the species was examined by nuclear magnetic resonance and FT-IR spectroscopy. The structure of **2** was confirmed by single-crystal X-ray diffraction studies (figure 1). It is a dimer based on two $Y(thd)_3$ units linked by a tmeda ligand in an unusual bonding mode. The yttrium atom is seven-coordinated, with a distorted monocapped trigonal prismatic geometry.

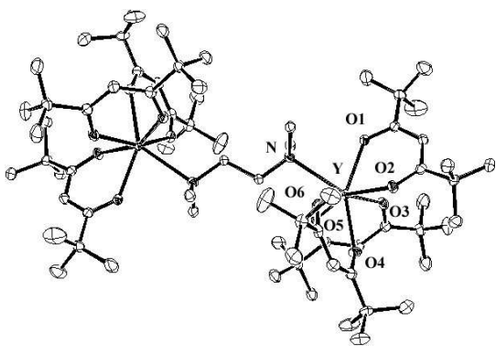



Figure 1 : Molecular structure of **2**

Their thermal behaviors were also characterized by TGA and sublimation experiments. Attempts to sublime **1-2** (140 °C under $P=2.10^{-4}$ torr) result in dissociation of the Y-TMEDA bond and sublimation of $Y(thd)_3$. Similar trends are observed on the DTA/TGA plots.

$Y(thd)_3$(TMEDA) **(1)**, due to its better solubility than **2**, was used to deposited YBCO films. We used the same deposition conditions that in previous works, for growth of YBCO films from β-diketonates [3].YBCO films deposited on $LaAlO_3$ and MgO were superconductor. XRD diagram corroborates the formation of the orthorhombic phase $YBa_2Cu_3O_7$ (PDF 84-1760). From figure 2, presenting the XRD diagram obtained from YBCO film on MgO, all (00l) diffractions peaks are present, and only a very small signal from the (103) diffraction is detected. Films were in-plane and out-of-plane textured. The thickness of the grown films was 800 nm. Films grown on $LaAlO_3$ presented a very sharp superconducting transition, with a Tc(onset) of 91K and a ΔTc of 0.6K. The Jc value for this sample was 0.2 $MA/cm^2$.

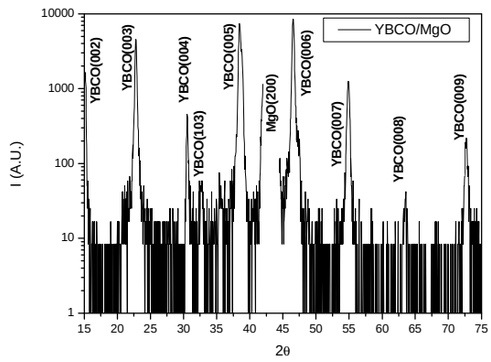



**Figure 2 :** XRD diagram from YBCO film on MgO

For the first time, homometallic $Y(thd)_3$ (TMEDA) **(1)** and $[Y(thd)_3]_2$(TMEDA) **(2)** have been prepared and characterized. These precursors are stable in air. Depositions of $Y_2O_3$ and YBCO has allowed to validate the use of $Y(thd)_3$(TMEDA) as precursor for PI MOCVD. In particular, deposition of YBCO from a single solution with β-diketonates for Ba and Cu was possible. These features seem very promising for the industrial fabrication of YBCO layers by MOCVD

1. I. Baxter, S. Drake, M. Hursthouse, J. McAleese, K. Abdul Malik, D. Michael, P. Mingos, D. Otway and J. Plakatouras, *Polyhedron*, **17**, 3777 (1998)
2. S. Drake,M. Hurthouse, K. Abdul Malik, S. Miller and D. Otway, *Inorg. Chem*., **32**, 4464 (1993)
3. A. Abrutis, J.P. Senateur, F. Weiss, V. Bigelyte, A. Teiserskis, V. Kubilius, V. Galindo and S. Balevivius, *J. of Crystal Growth*, **191**, 79 (1998)