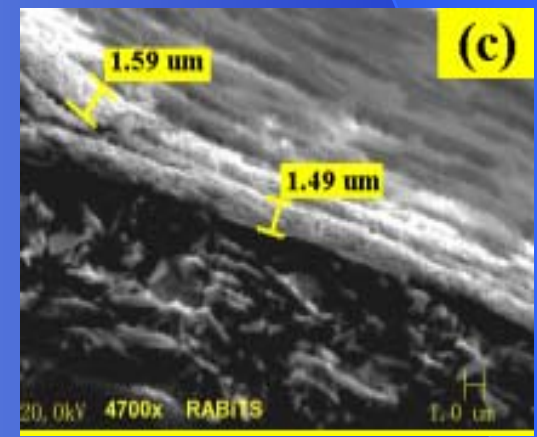
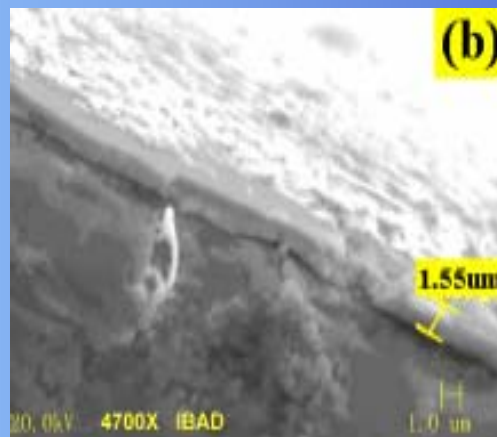
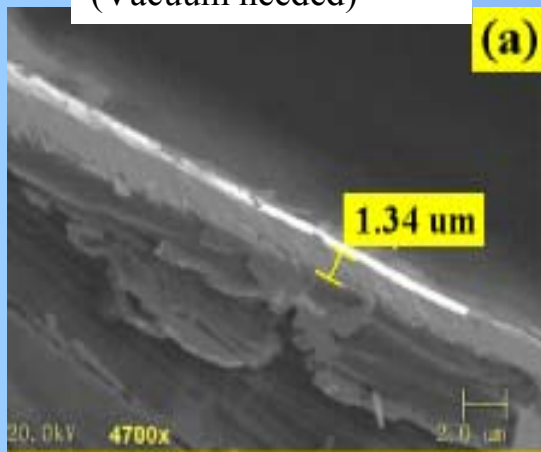
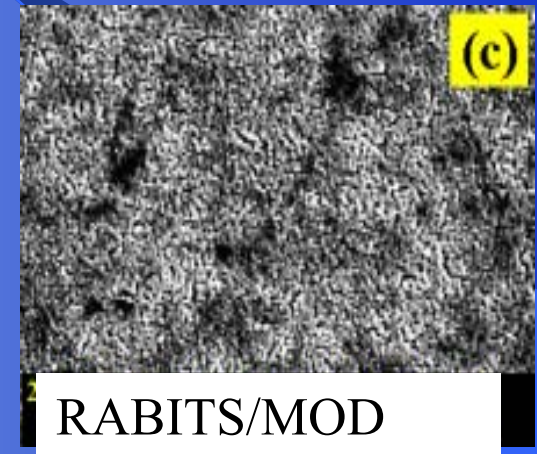
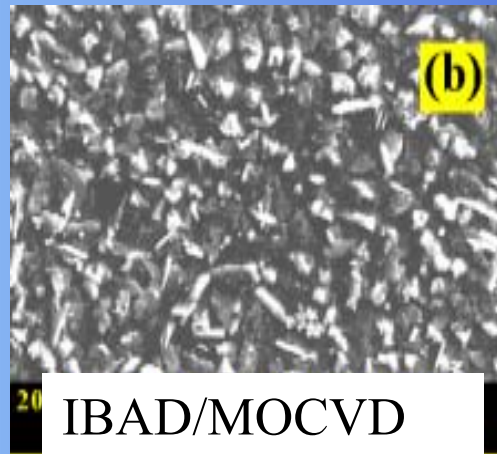
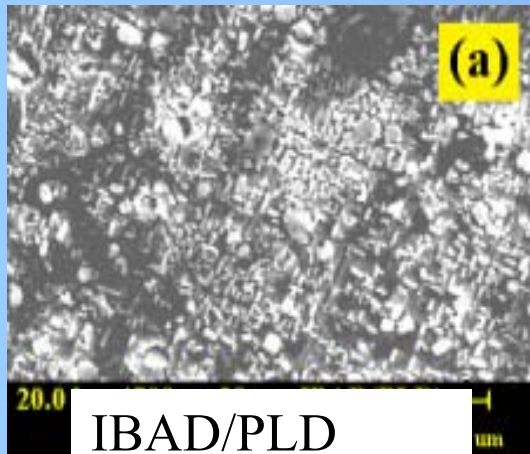


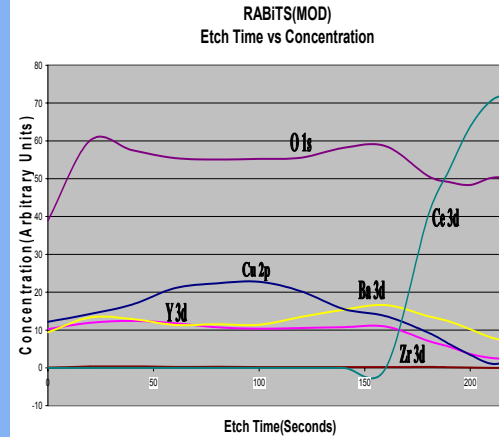
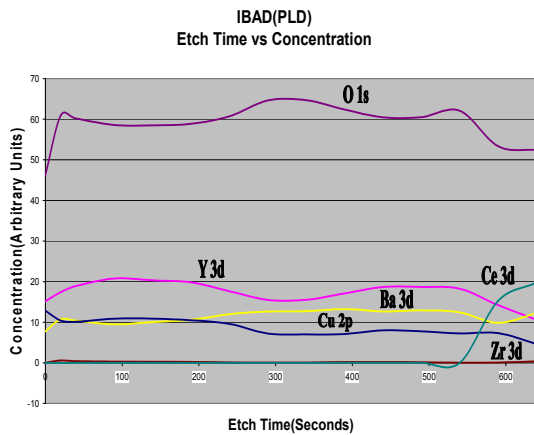
Spectroscopic & Microscopic Comparison of Present Day Coated Conductors (1-2 MA/cm²)

S. M. Mukhopadhyay,

S. Krishnaswami, J. Sun, S. Vemulakonda, V. Chintamaneni, S. Sengupta



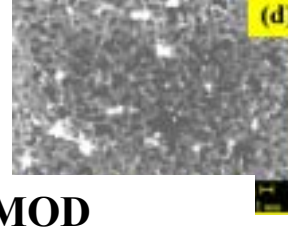
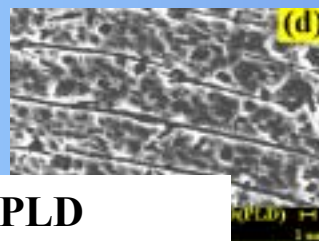
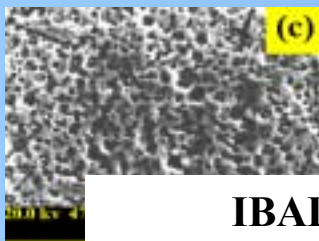
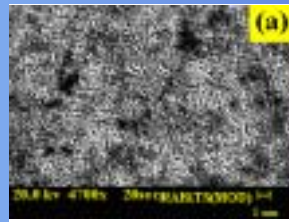
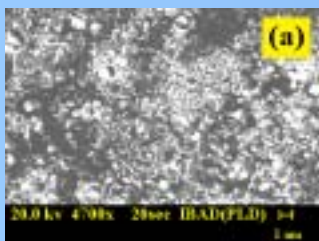
Concentration profile: Chemical Etching and XPS Data



Compared to PLD and MOCVD films, TFA films have comparable J_c , but

- Higher porosity
- Faster Etching Rates

Micro-structural variation with depth into film



IBAD/PLD
(etch rate < 3 nm/sec)

TFA/MOD
(etch rate > 8 nm/sec)

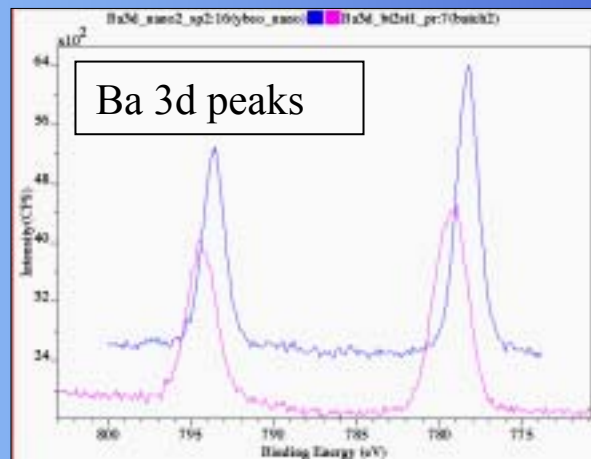
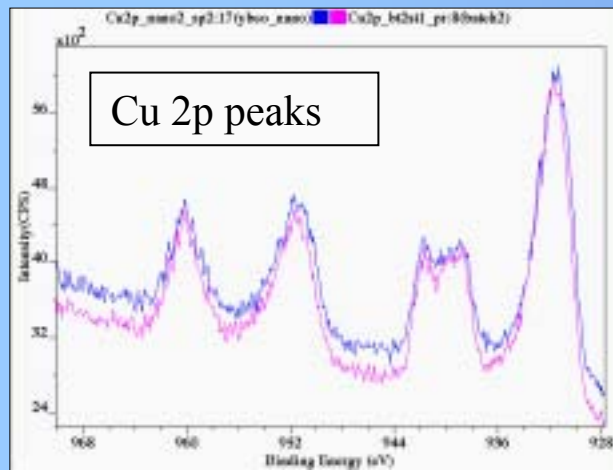
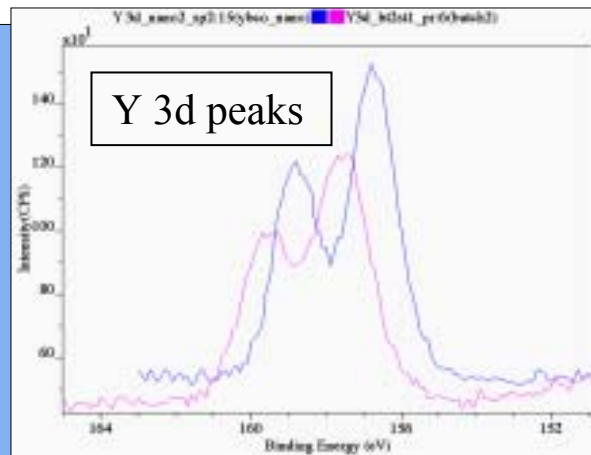
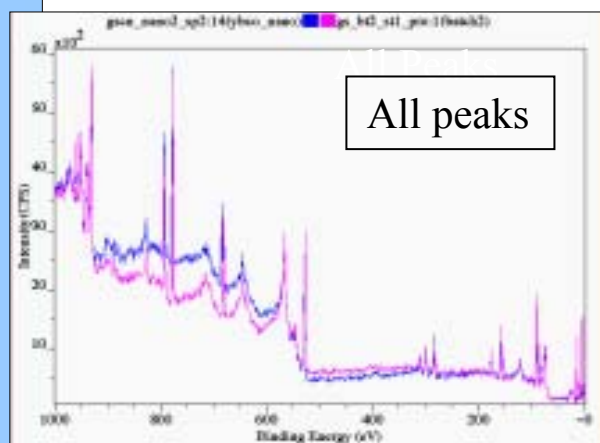
To make this approach more attractive:

- Incorporate Nanoparticles of CeO_2 in TFA solution
- Increase film density

Modified MOD approach (in collaboration with MMP Inc.)

Attempt to enhance density while maintaining stoichiometry and texture

- Synthesis of nanoparticles (~10 nm) of Y-Ba-Cu-O in colloidal form.
- Deposition of a well-packed dense film
- Heat treatment to achieve crystallization and epitaxial growth
- **Proven success in ZrO₂, CeO & Ba-Sr-Ti-O films**



Results to date (Jan 05)

Comparison of Chemical States of Precursor Films

Nano-colloids of Y-B-C-O Vs. TFA/MOD

- Y-O in this approach Vs. Y-Ba-O-F in TFA/MOD.
- Denser film, but wetting problem to be resolved.

In Summary.....



- ✓ **Control of Cationic States in all complex solids** is an ongoing battle. Coated Conductors (CC) have their share of challenges. Cross-communication between different applications may help
- ✓ Most successful results to date are in PLD material (pure, RE-doped, nano-particle pinned, etc.)
- ✓ MOD (TFA) samples have best results among non-vacuum techniques, but films have significantly higher porosity (not very robust?).
- ✓ Can Colloidal processing approaches developed for other multi-cation oxides be extended to Y-B-C-O compounds? Worth trying. Initial data show promise
- ✓ Incorporation of nano-scale defects in these samples may be simpler.
 - Nanoparticles in solution/suspension*
 - RE and Lanthanide Dopants for flux pinning*
 - Uniformly dispersed second phase nano-inclusions in buffer layers*

Chemical Comparison: MOD (in house) Vs PLD (AFRL)

