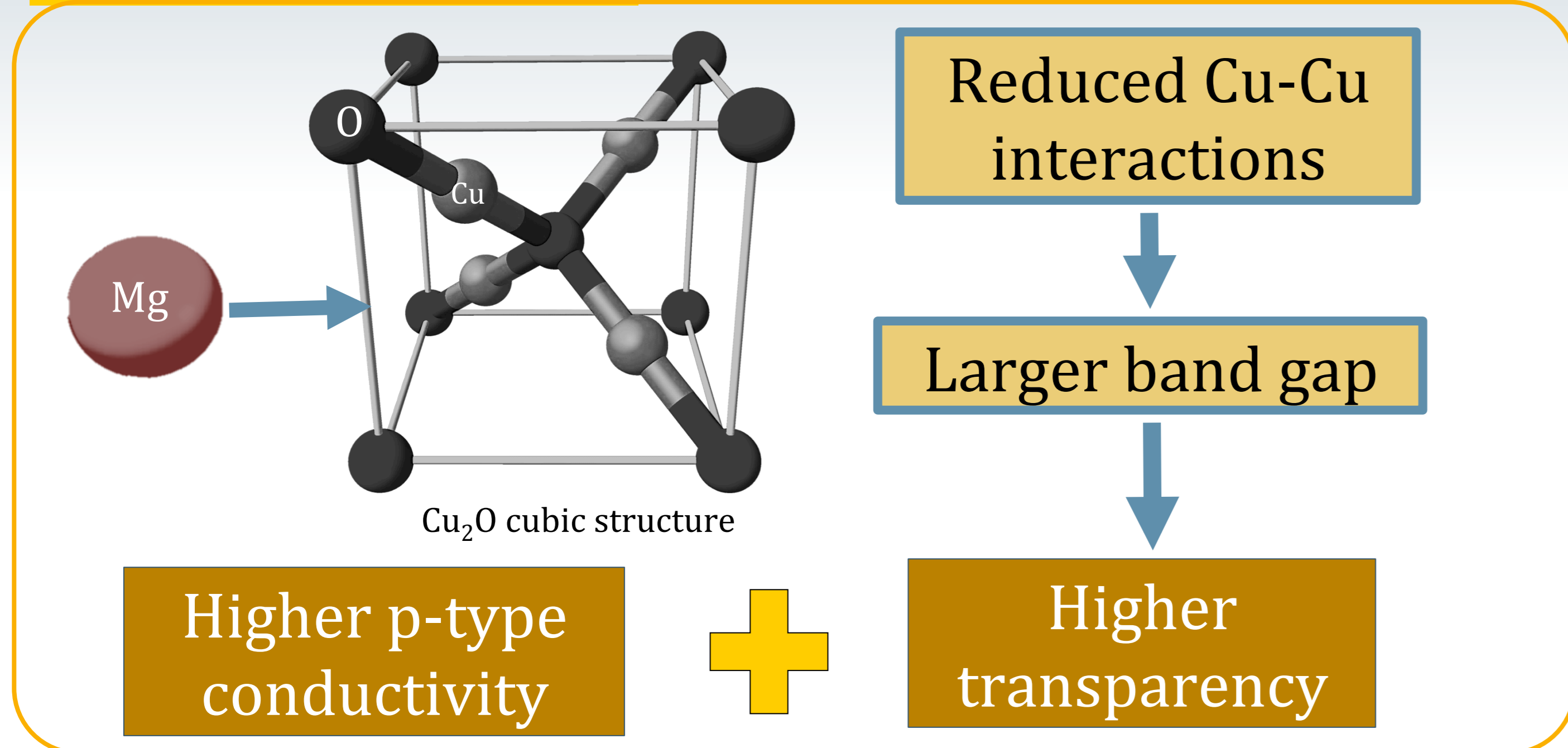


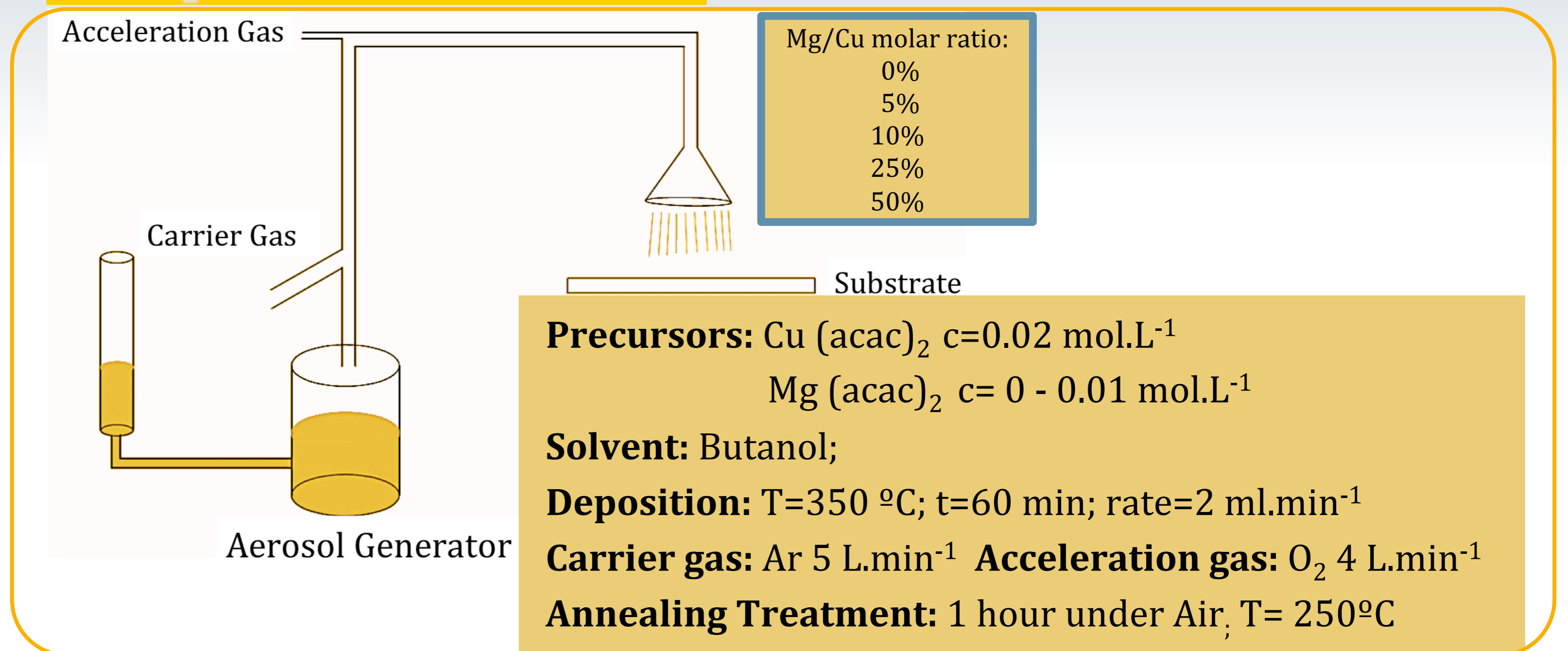
Magnesium-doped Cuprous Oxide (Mg:Cu₂O) thin films as a transparent p-type semiconductor oxide

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Motivation



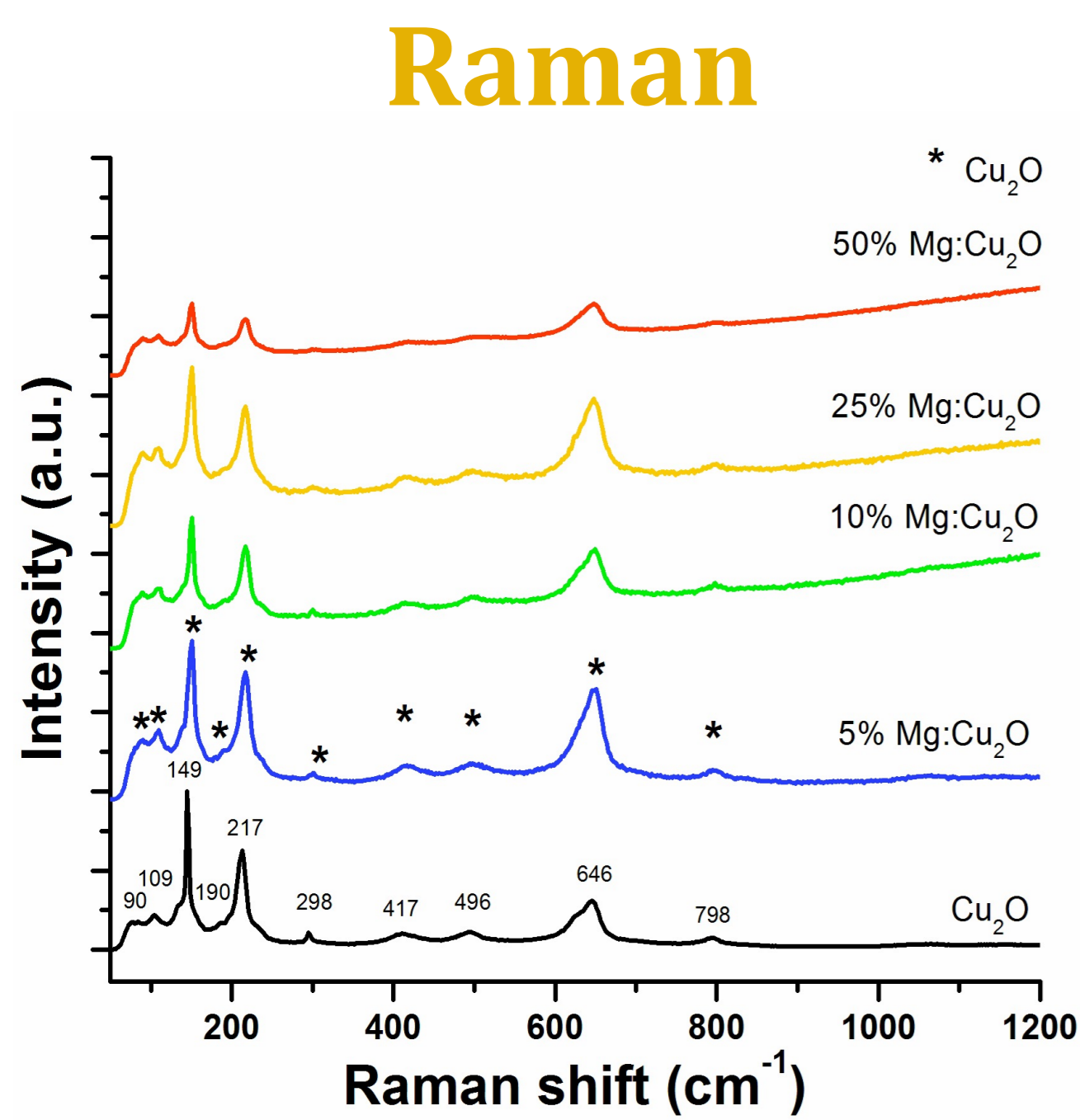
Experimental



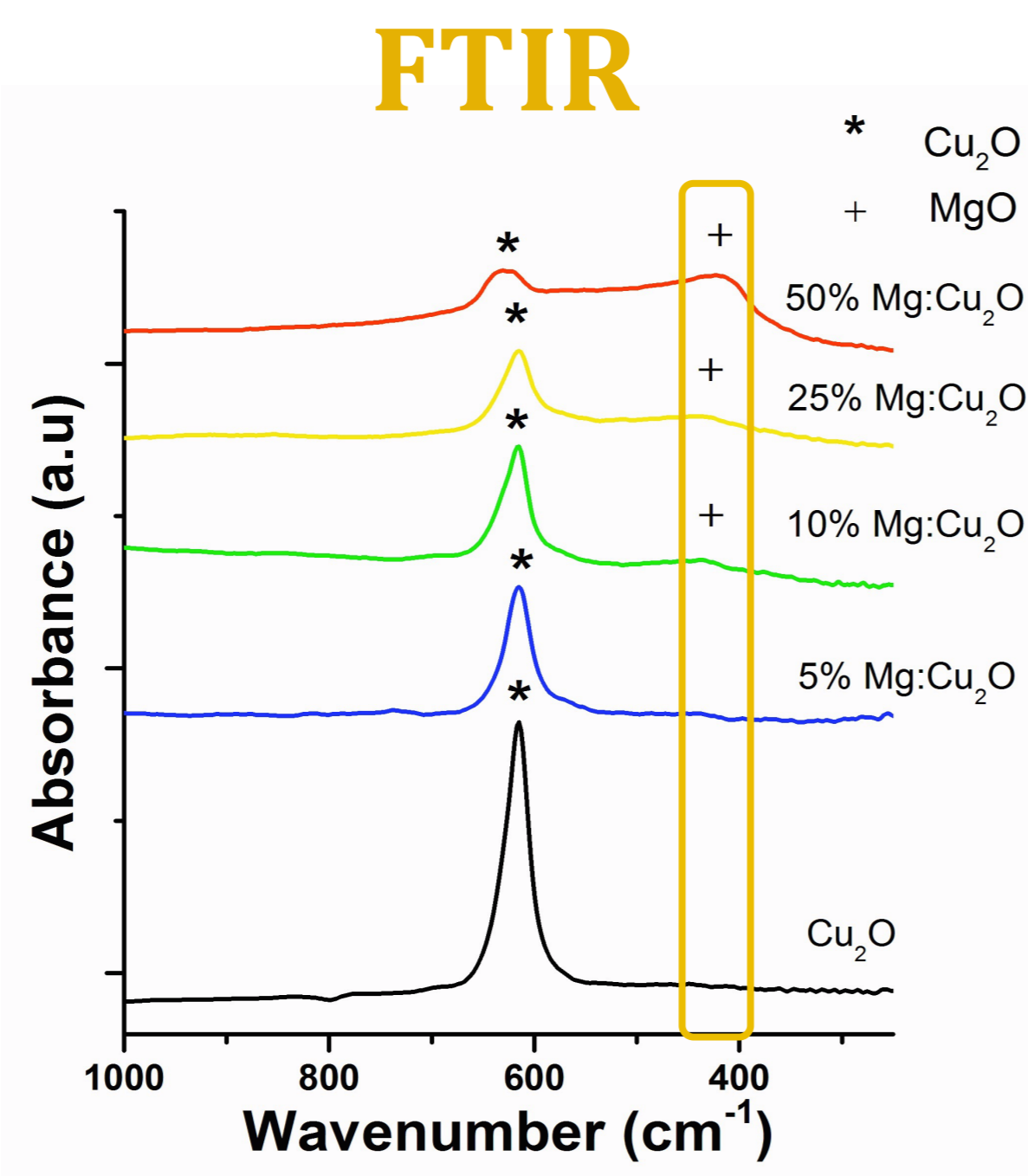
Results

Optical Appearance

Mg:Cu₂O thin films deposited on glass and silicon

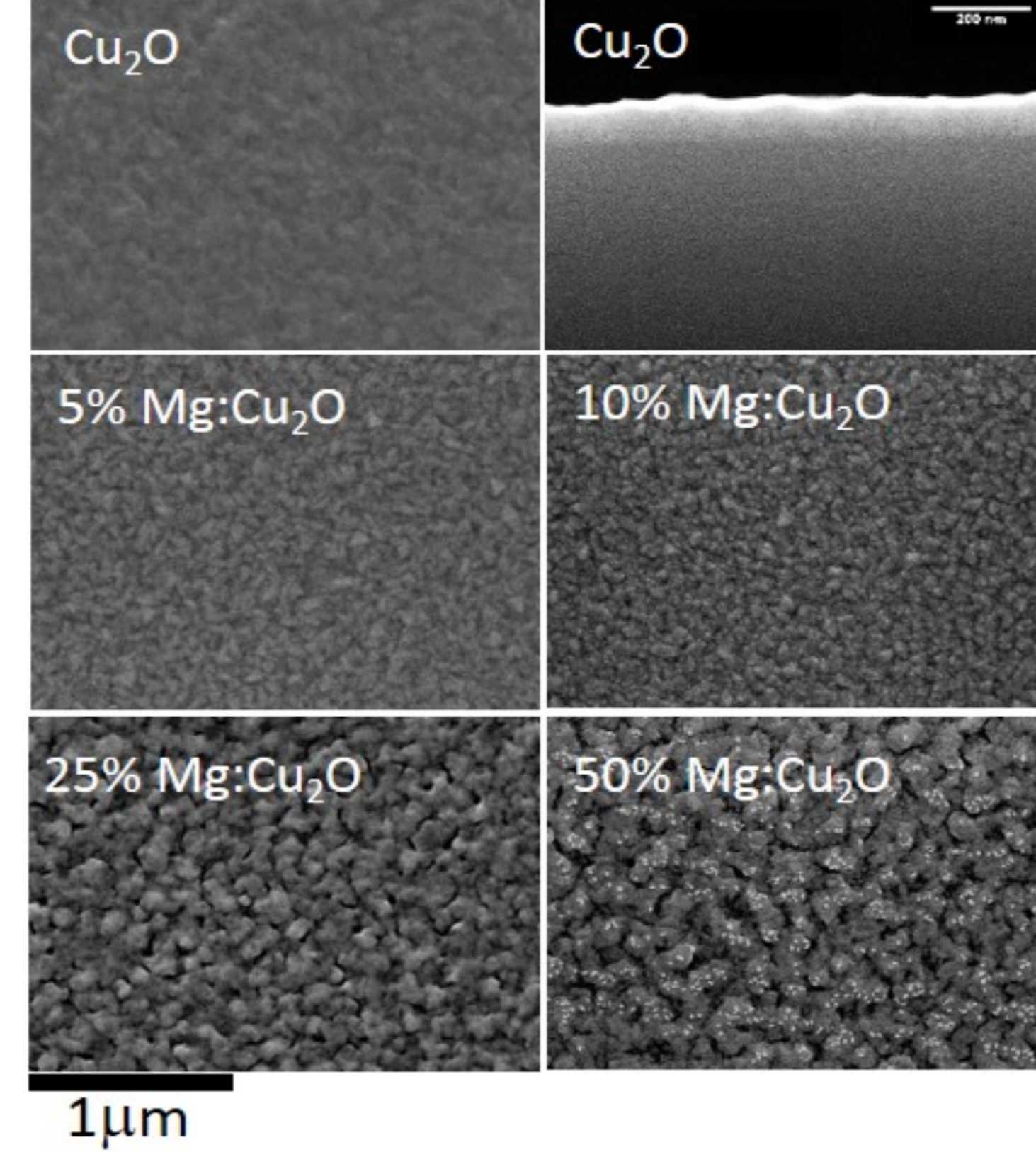


Cubic Cu₂O phase detected



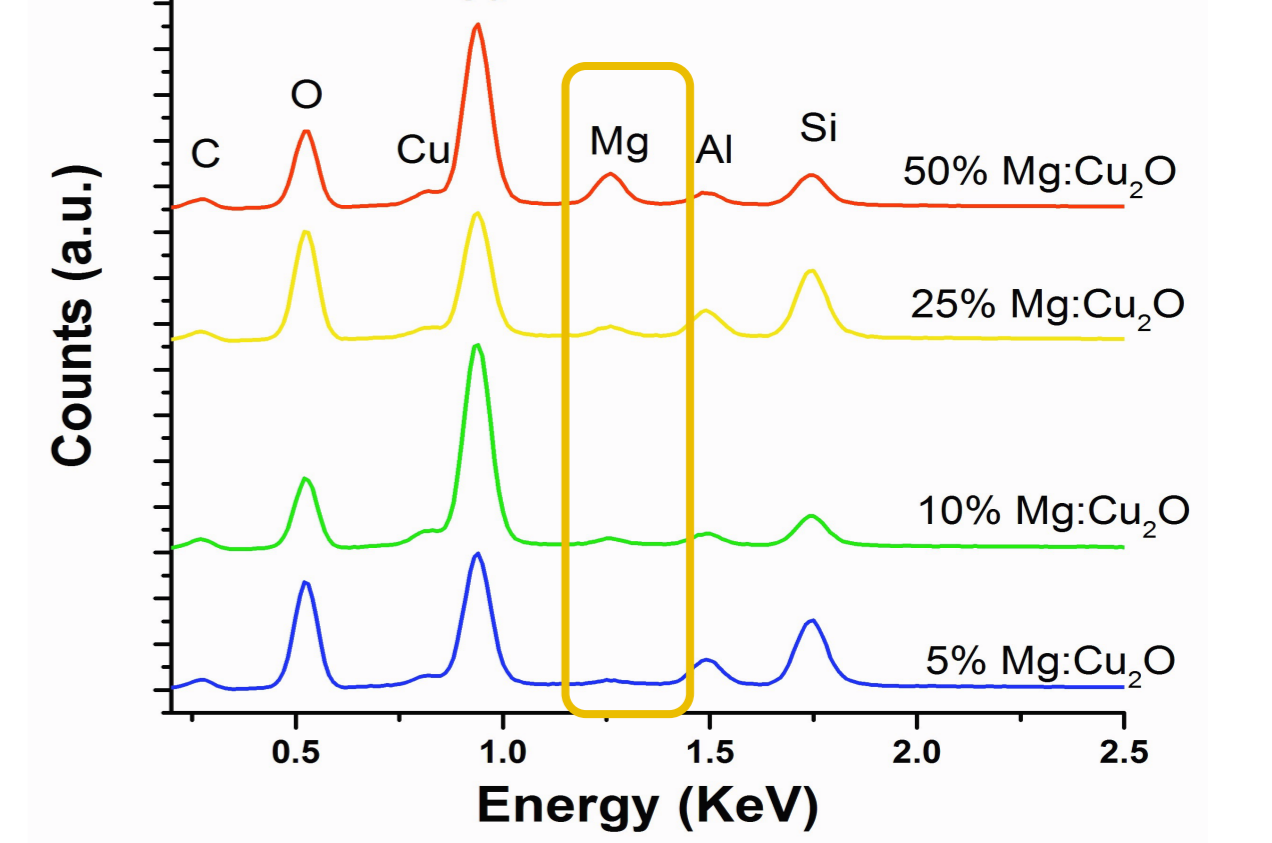
Mg-O bond detected at 436 cm⁻¹

SEM



Larger grains with the increase of Mg content; Thickness below 100 nm

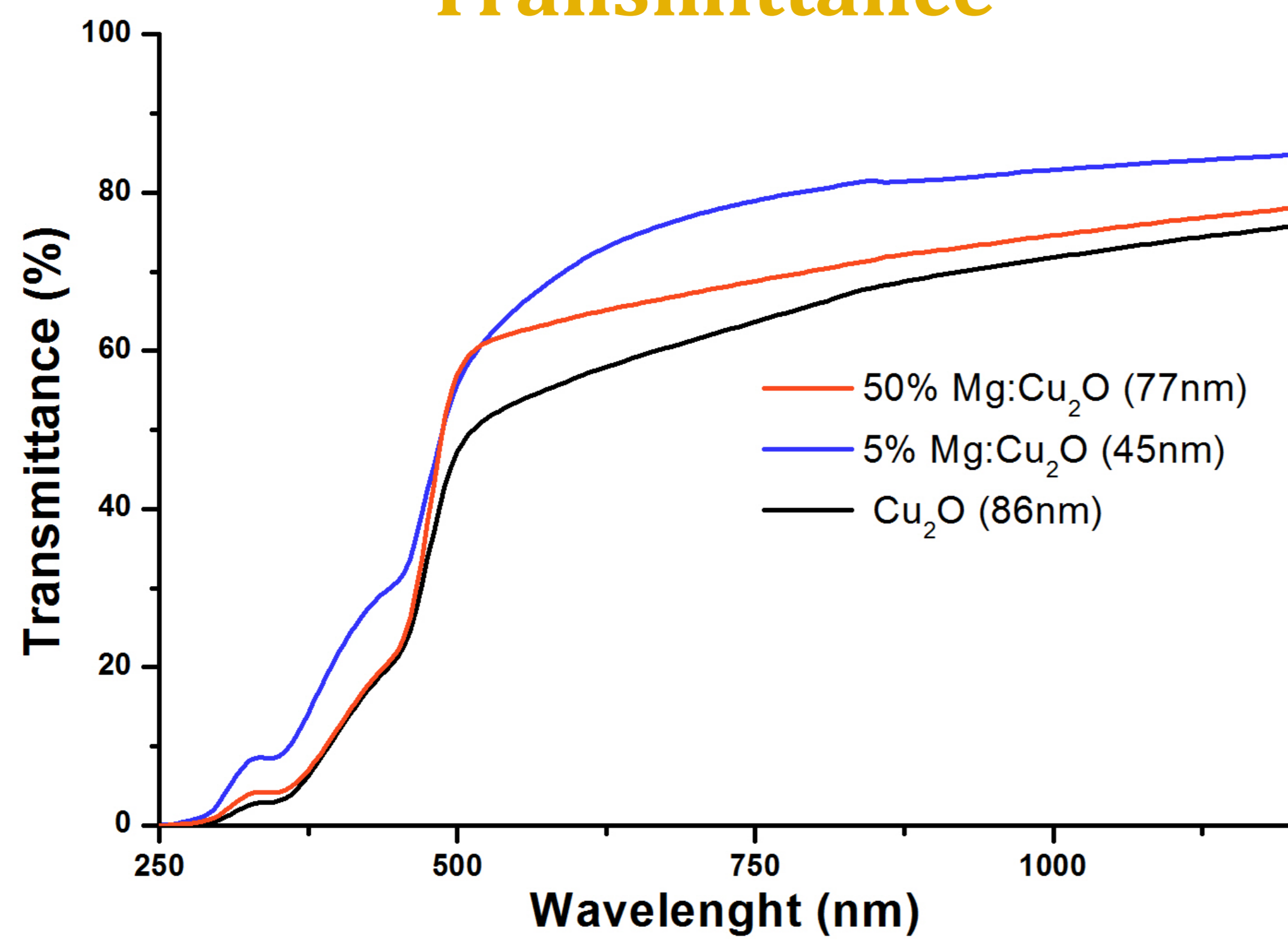
EDS



Mg/Cu in solution (%)	Mg/Cu in film (%)	Thickness (nm)
0	-	86
5	2.5	45
10	3	97
25	7	52
50	20	77

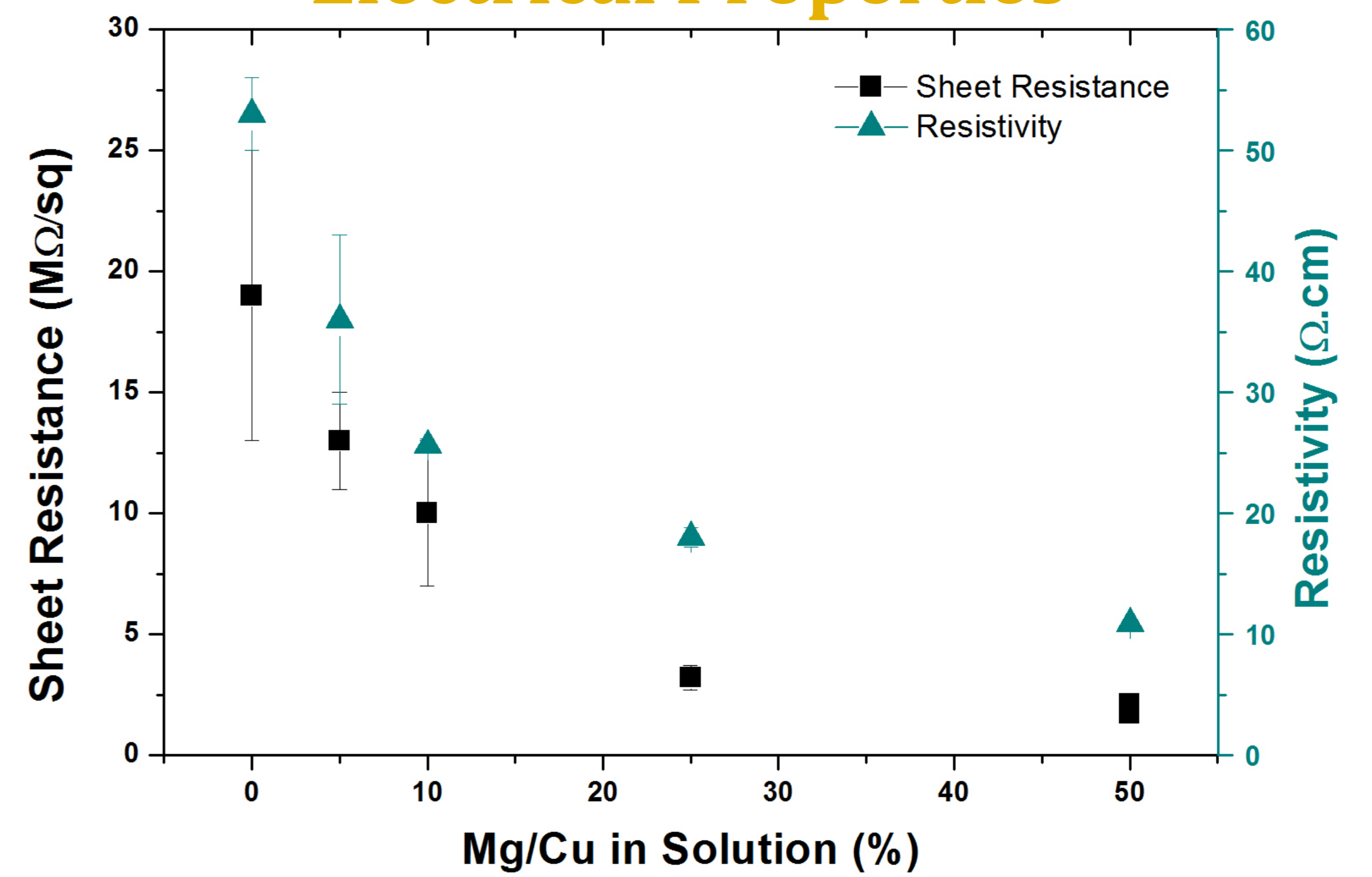
Mg detection by EDS and Mg/Cu ratio quantification

Transmittance



Visible Transmittance around 50%
 E_g ~ 2,2eV

Electrical Properties



Decreasing behavior of sheet resistance and electrical resistivity with increasing content of Mg
 P-type conduction confirmed by Hall Effect

Conclusions

- Successful incorporation of Mg on Cu₂O thin films by MOCVD with a thickness below 100 nm;
- FTIR confirms the presence of Mg-O bonds;
- Elemental quantification by EDS shows Mg/Cu ratios 2 to 3 times lower than Mg molar mass in the original solution;

- The predicted changes in transparency [Nolan 2008] were not obtained by this cation incorporation;
- For films with high Mg content, the resistivity is reduced five times, from 53 Ω.cm to 11 Ω.cm. The causes can be attributed to:
 - Different microstructure: Larger grains – Higher mobility.
 - Higher amount of copper vacancies – More charge carriers.