

#### Study of Tb3+-Yb3+ doped Silicon Nitride frequency conversion layers for Solar Cell Applications

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# Study of Tb<sup>3+</sup>-Yb<sup>3+</sup> doped Silicon Nitride frequency conversion layers for Solar Cell Applications





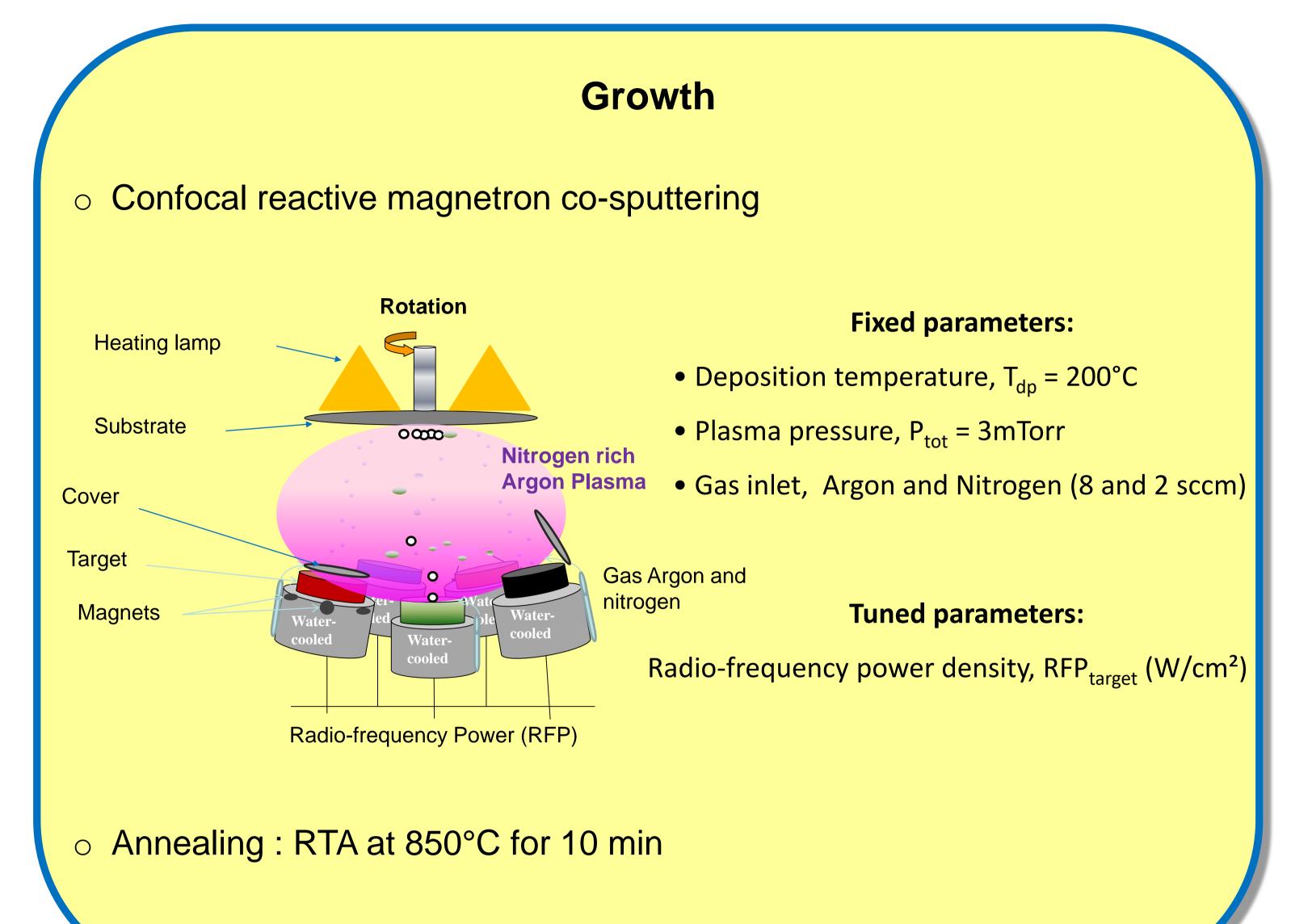


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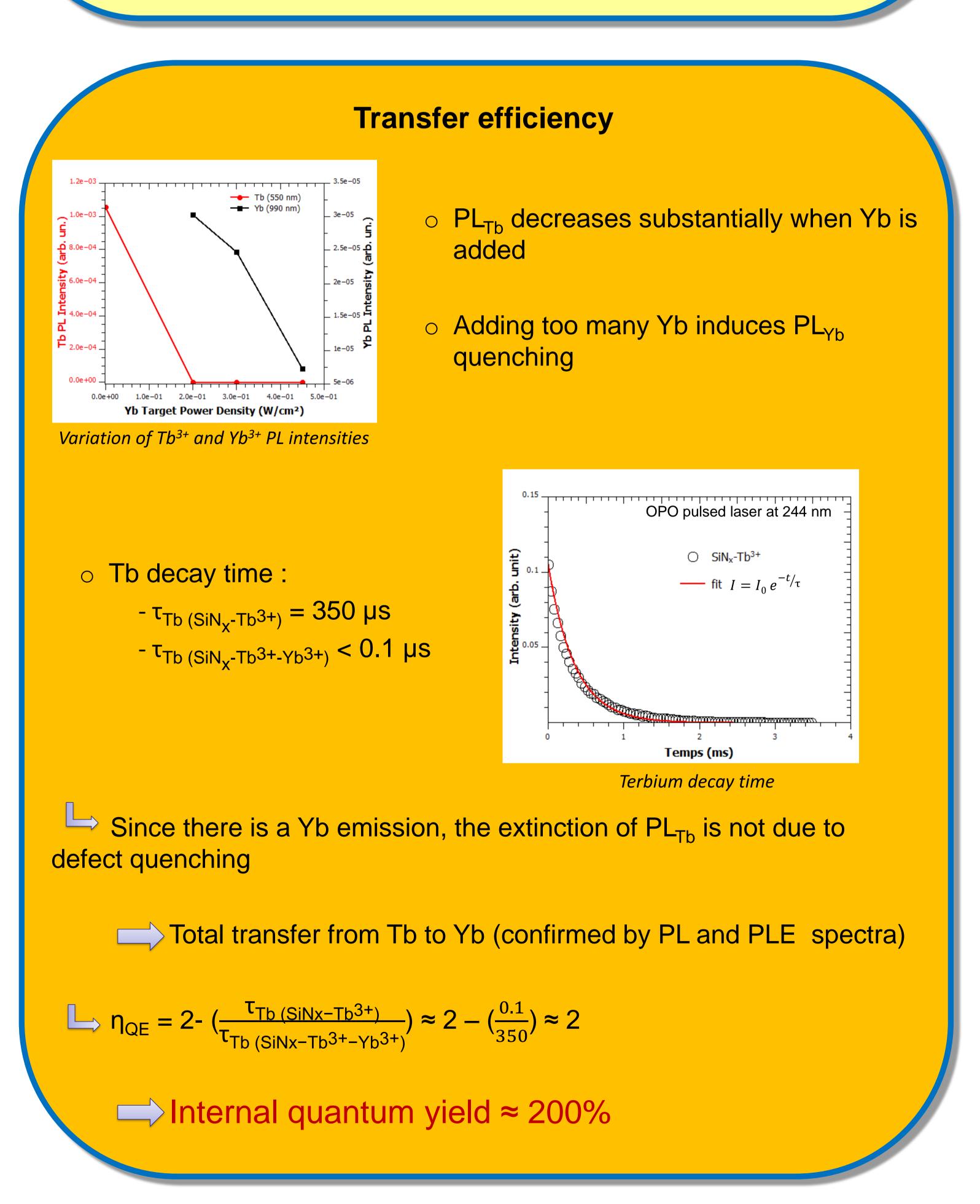
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## **Motivations** Improving solar cells efficiency by adding a Down-Conversion layer on top of it → Tb<sup>3+</sup>-Yb<sup>3+</sup> doped Silicon Nitride System compatible with the Si solar cell fabrication → SiN<sub>x</sub> as matrix **√7** ~ 2.6 eV 488 nm ~ 2.5 eV ~ 1.25 eV Tb<sup>3+</sup> Yb<sup>3+</sup> Yb<sup>3+</sup> Matrix Solar cell



### SiN<sub>x</sub>-Tb<sup>3+</sup> system Exc. wavelength 330 nm Significant Tb emission at a non resonant excitation wavelength Energy transfer from the matrix to Tb<sup>3+</sup> 600 650 Wavelength (nm) Terbium photoluminescence Yb<sup>3+</sup> addition :Optimisation of the layer chemistry in order to obtain the maximum PL intensity At 285 nm excitation Sizeable PL<sub>Yb</sub> peak only in the presence of Tb<sup>3+</sup> Energy transfer 5.0e-05 from Tb<sup>3+</sup> to Yb<sup>3+</sup>? Ytterbium photoluminescence → Yb 0.2 W/cm² R = 4/1--- Yb 0.3 W/cm² 0.00012 The higher intensity **4 ₺** 0.0001 achieved for: $RFP_{Tb} = 4 RFP_{Yb}$ Tb Target Power Density (W/cm²) PL Intensity study for various power density



### Conclusion

- > Evidence of the efficiency of the energy transfer from the matrix to Tb and from Tb to Yb
- Maximum internal quantum yield of 200%
- Process totally compatible with the industrial solar cells



