Solution Processed MoO_x Thin Films as Hole Selective Contacts for Silicon Solar Cells

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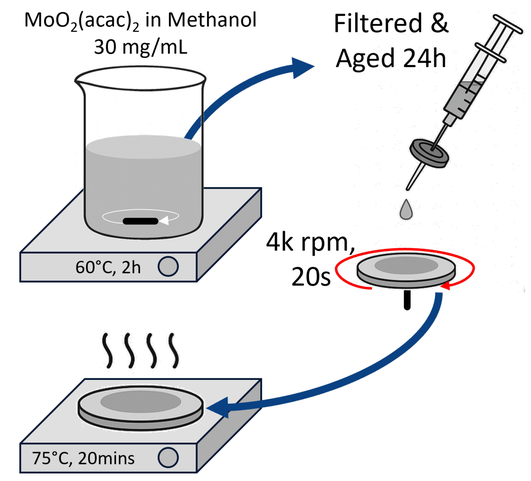
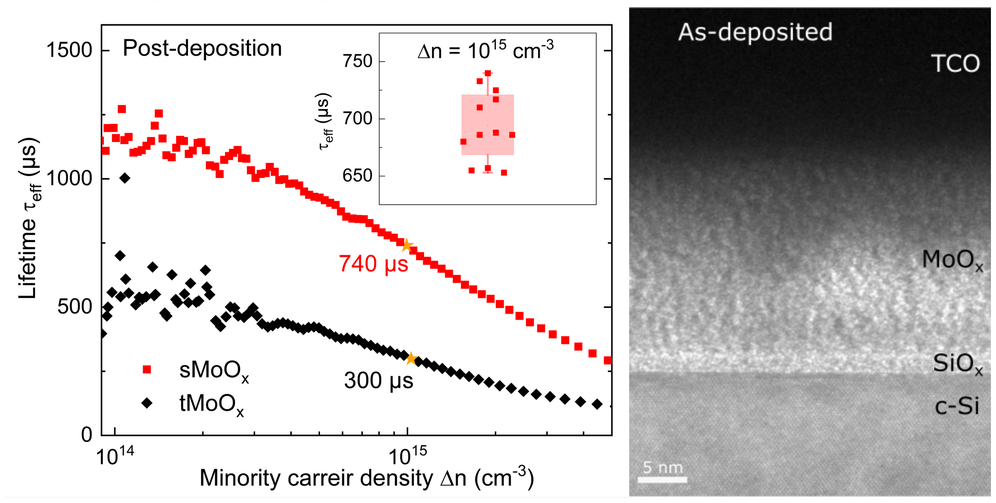
Abstract

Molybdenum oxide (MoO_x) is a promising hole-selective contact for silicon solar cells, but thermally evaporated $tMoO_x$ suffers from poor thermal stability. This work examines solution-processed $sMoO_x$ with various capping layers, showing improved passivation and markedly better thermal stability. Carrier lifetimes up to 740 µs are achieved, and > 400 µs is maintained to 300°C with an indium-oxide capping layer. Although contact resistivity (~0.3 Ω·cm²) is higher, it remains suitable for full-area contacts.



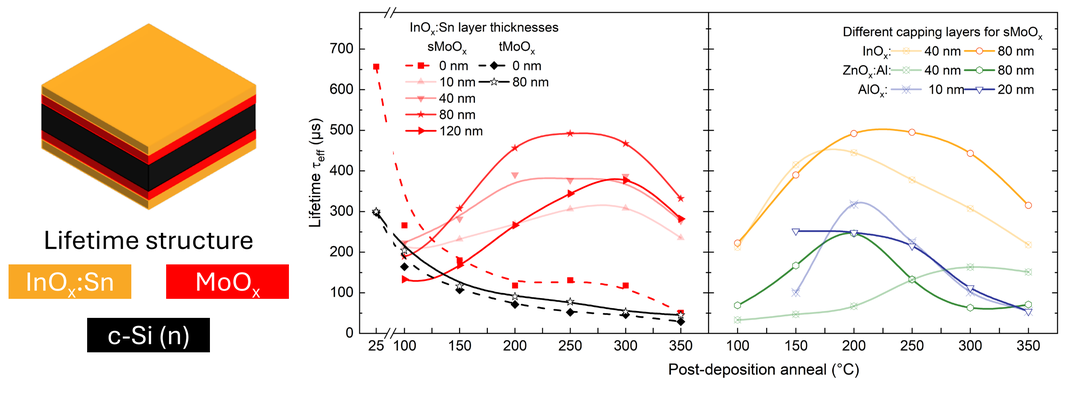
Passivation Performance

- Effective carrier lifetime (τ_{eff}) for $sMoO_x$ reached up to 740 µs
- Passivation attributed to the formation of a thin SiO_x interlayer during chemical deposition.



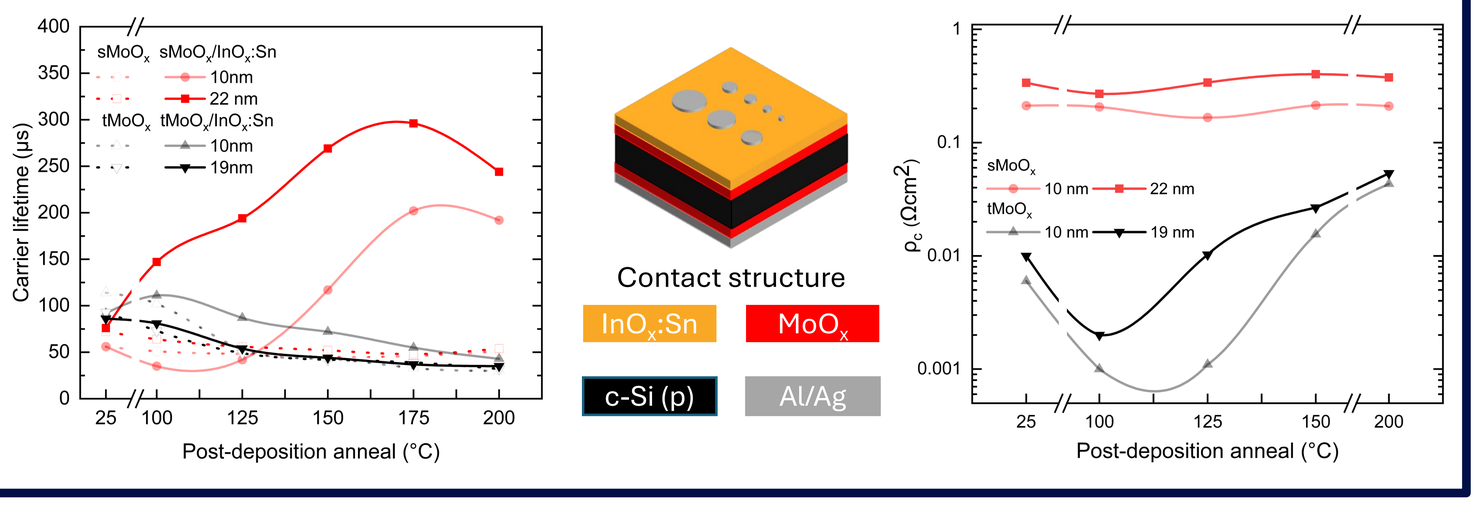
Capping Layer Effects

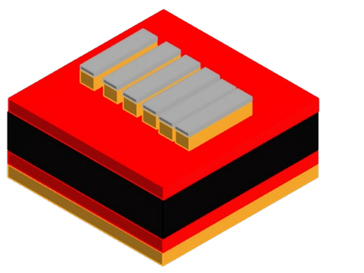
- ITO capping configuration achieved τ_{eff} ≈ 500 µs around 250 °C and maintained τ_{eff} > 200 µs at 350 °C.
- This improvement is attributed to hydrogen retention at the c-Si/SiO_x/$sMoO_x$ interface during annealing.
- InO_x capping also achieved τ_{eff} ≈ 500 µs after annealing up to 300 °C, comparable to ITO.

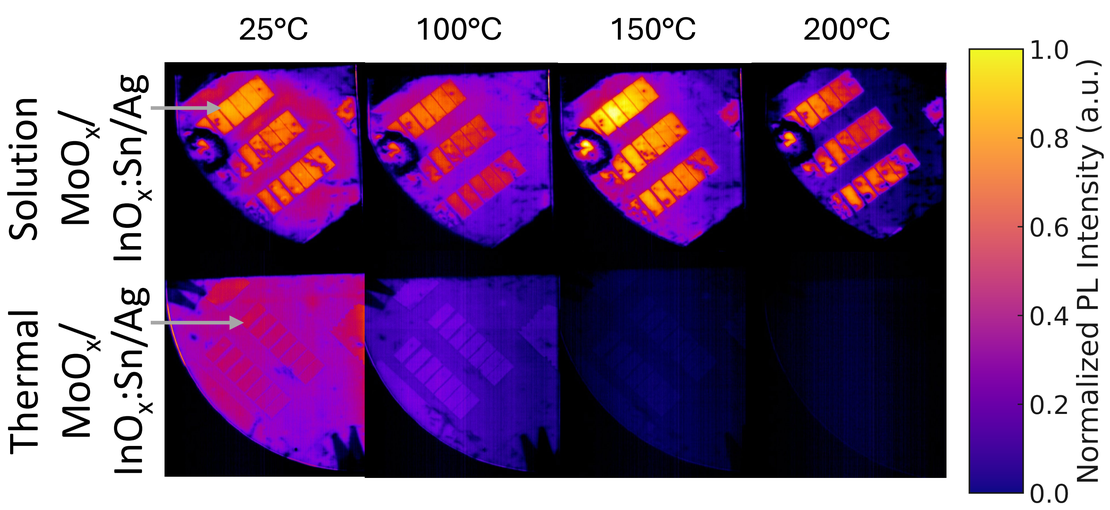


p-type Passivation and Contact Resistivity

- While initial passivation lifetime was lower on p-type c-Si (τ_{eff} = 50–150 µs), annealing improved lifetimes for $sMoO_x$ with ITO capping layers, reaching up to τ_{eff} = 300 µs for ~22 nm films.
- Although contact resistivity ρ_c values for $sMoO_x$ (~0.3 Ω cm²) is higher than $tMoO_x$, it remains suitable for full-area contacts.







Post-Metallization Stability

$sMoO_x$/ITO stacks retained and even enhanced passivation after Ag metallization and annealing, unlike $tMoO_x$, which degraded rapidly above 100 °C.

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Read more about this work:
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