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An analysis of Opto-electronic characteristics of $Zr_xHf_{1-x}O_2$/Al/$Zr_xHf_{1-x}O_2$ thin-films deposited at different substrate temperature

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INTRODUCTION & AIM

- The opto-electronic characteristics of Zr-doped HfO_2 has been thoroughly investigated by many researchers, yet further research is needed to fully understand this material.
- To improve the electrical and optical characteristics of Zr-doped HfO_2 thin films, experiments involving novel structures are crucial.
- Substrate temperature also has a significant impact on the various properties of the film
- The main aim of this work is to explore the opto-electronic characteristics of $Zr_xHf_{1-x}O_2$/Al/ $Zr_xHf_{1-x}O_2$ trilayer thin-film.

METHOD

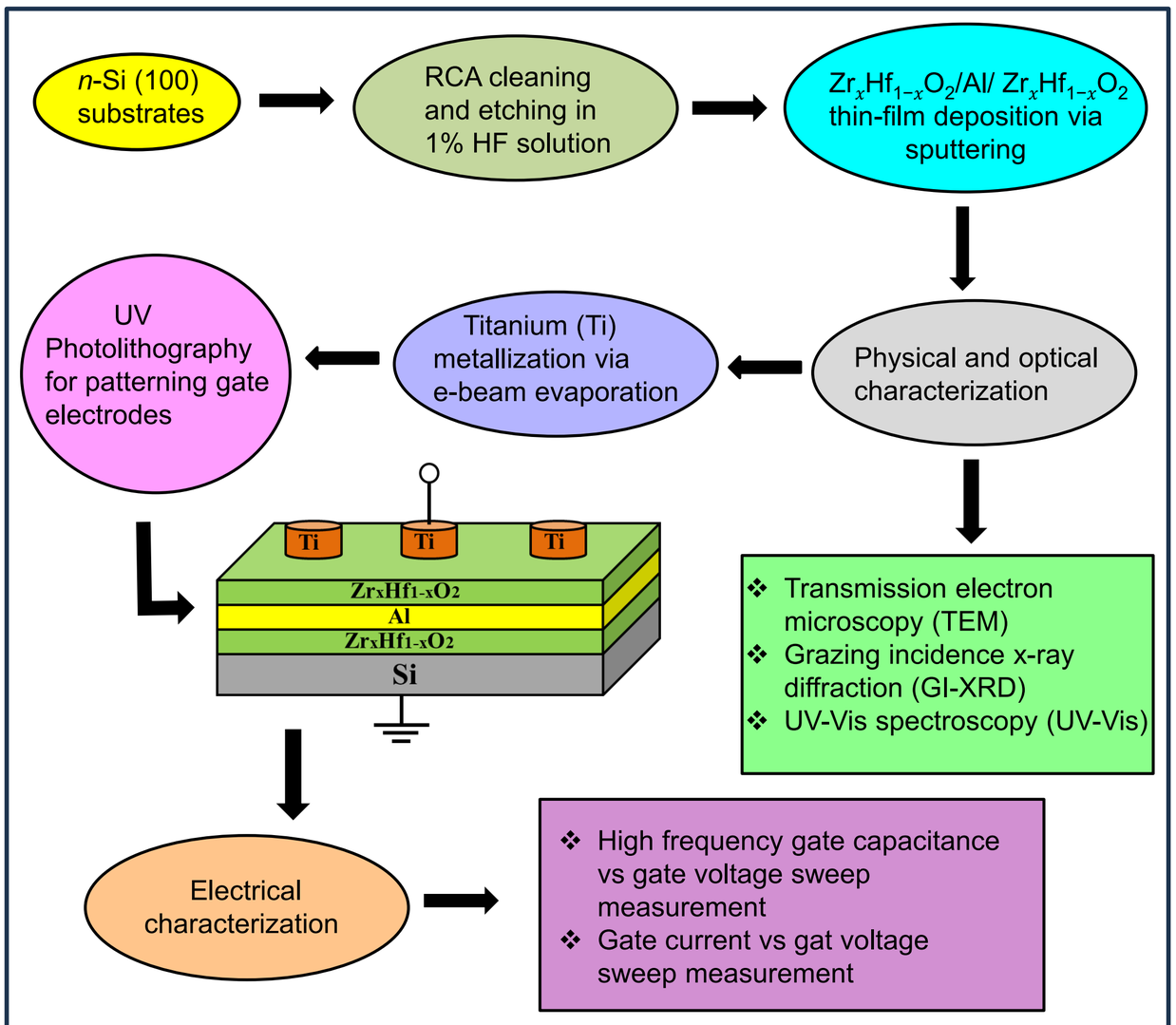

Figure 1. Flow chart of the work

$Zr_xHf_{1-x}O_2$/Al/ $Zr_xHf_{1-x}O_2$ trilayer thin-films are deposited at 25 (RT), 150 and 300 ˚C substrate temperatures.

Acknowledgements

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RESULTS & DISCUSSION

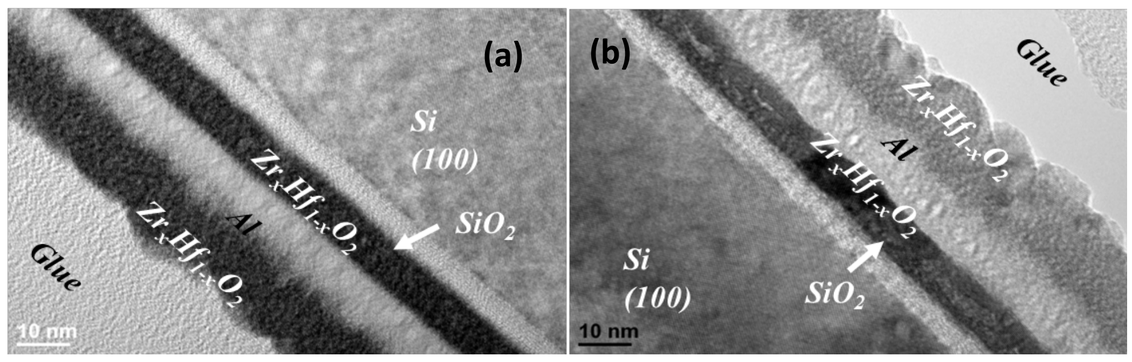

Figure 2. Cross-sectional TEM images for the (a) RT and (b) 300˚C samples

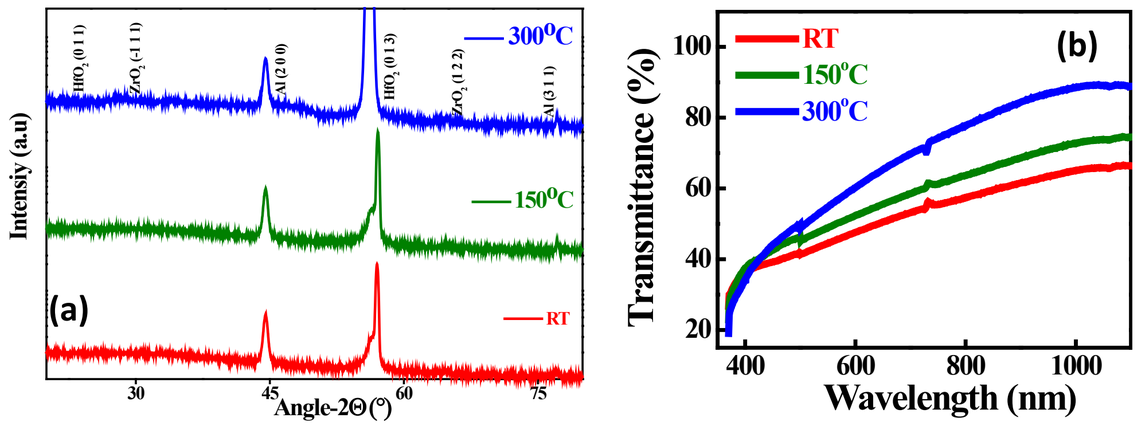

Figure 3. (a) GI-XRD scans and (b) optical transmission spectra of all the thin-films

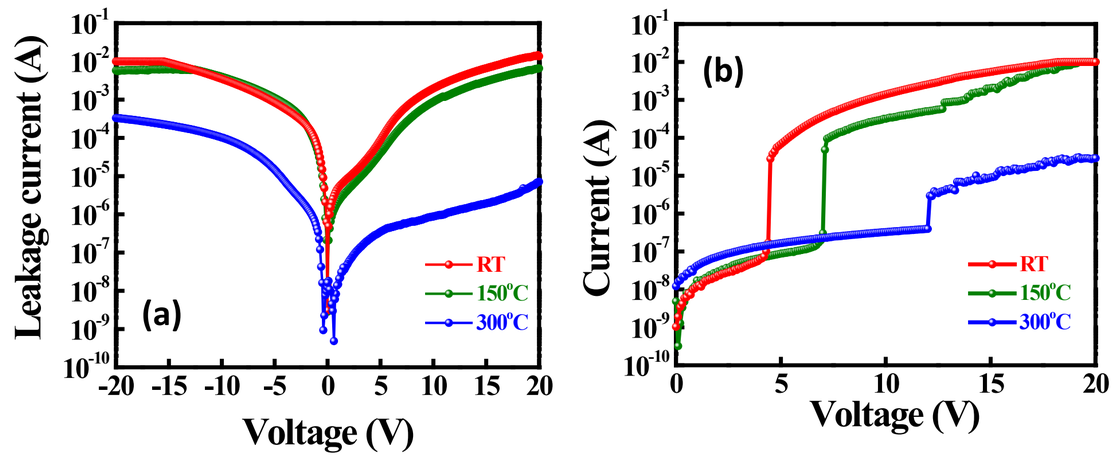

Figure 4. (a) Leakage current-voltage and (b) breakdown curve of all the thin-films

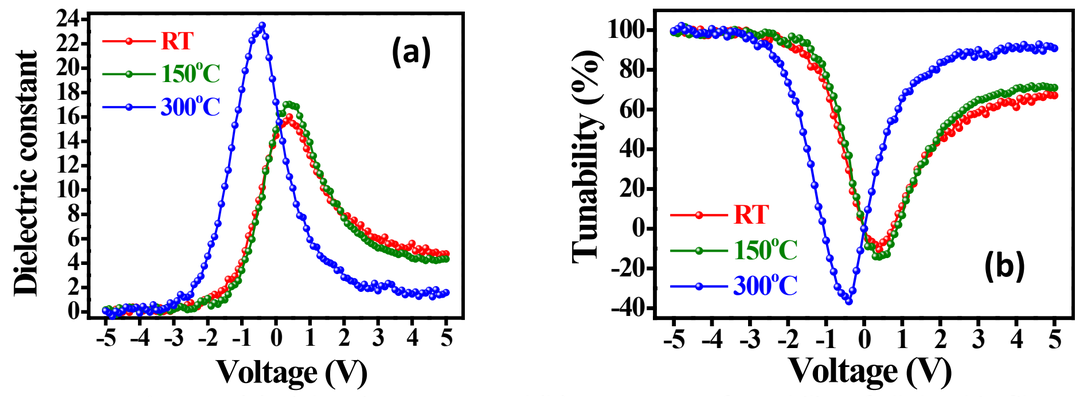

Figure 5. (a) Dielectric constant and (b) percentage of tunability of all the thin-films

CONCLUSION

- The film deposited at 300˚C shows improved crystallinity, optical transmittance above 89% in the visible range, enhanced electrical properties, including a 90% tunability and enhanced figure of merit upto 52.82, as well as a drop in leakage current ~ 10^{-6} A.
- Considering the above results it can be concluded that trilayer $Zr_xHf_{1-x}O_2$ /Al/ $Zr_xHf_{1-x}O_2$ thin-film deposited at 300˚C can be used in opto-electronic devices.

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