Effect of chemical precursors in combustion processing of solution based AlOx dielectric for GIZO TFTs

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Introduction

In the last years, significant efforts have been made in the synthesis of a wide range of inorganic dielectrics using chemical solution routes do to their versatility, low cost and scalability for printed and flexible electronics. Solution synthesis provides a wide range of variables that can be tuned to yield the desired material. In solution combustion of oxide materials the most determinant parameters are the metal source and organic fuel as these influence the oxide formation temperature and properties. [1–2].

In this work the effect of different metal precursors; aluminum chloride and aluminum nitrate, and organic fuels; urea (U) and citric acid (CA), on the properties of solution-processed aluminum oxide thin films was investigated. These films were then applied as dielectric layer in gallium-indium-zinc oxide (GIZO) thin film transistors (TFTs) and the influence of the chemical route on their performance was accessed.

Experimental Section

Results

Conclusions

- Thermal analysis of precursor solutions reveals that when using aluminium nitrate and citric acid the typical exothermic behaviour occurs at lower temperature leading to film formation at lower temperatures.
- The dielectrics with aluminum chloride as precursor solution show a higher hysteresis or a bigger variability of the capacity with frequency.
- The capacitors produced with aluminium precursor solutions with citric acid as fuel reveal a higher hysteresis and leakage current density. That is explained by the size of the citric acid organic molecule when compared to urea, causing low agglomeration of particles when occurs the combustion reaction resulting in a porous film.
- The optimized GIZO TFTs were prepared from aluminium nitrate precursor solution using urea as fuel shows a saturation mobility of 27.9 cm²/V-s, with an on/off current ratio of 7.2×10⁴.

References

Acknowledgments
This work is funded by FEDER funds through the COMPETE 2020 Programme and National Funds through FCT - Portuguese Foundation for Science and Technology under the project number POCI-01-0145-FEDER-007688, Reference UID/ICT/50025. The work has also received funding from the European Communities 7th Framework Programme under grant agreement ICT-2013-10-611070 (i-FLEXIS).