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Properties of hafnium-aluminum-zinc-oxide thin films for the application of oxide-transistors

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ABSTRACT

Hafnium-aluminum zinc oxide (HAZO) films as an active layer of oxide-transistors with different hafnium (Hf) contents were deposited via co-sputtering of separate targets. The effects of the sputtering power during co-sputtering on the structural, optical, electrical, and chemical properties of the HAZO films were examined. As the sputtering power increased, the structure of the HAZO films changed from polycrystalline to amorphous, and the Hf-O bonds in the HAZO films increased, but the Zn-O bonds decreased. Also, a bottom-gate-type thin-film transistor (TFT) using the HAZO film as its channel layer was fabricated and characterized. The TFTs using HAZO layer at room temperature as channel layer exhibited the device characteristics, such as a field effect mobility of 0.45 $cm^2/V{\cdot}s$, a threshold voltage of 17.18 V, a subthreshold swing of 0.85 V/decade, an on/off current ratio of 3.68×10^7, and a visible transmittance of 82.7%. It was discovered that the changes of the electrical characteristics of the HAZO TFTs were closely related to the changes of the Zn-O/Hf-O bonding ratio.

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