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Reactive ac magnetron sputtering with a pulsed reactive gas flow control applied to depositions of ZrO2 films

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Densified and highly optically transparent zirconium dioxide films (extinction coefficient below 0.001 at the wavelength of 550 nm) were prepared by reactive ac magnetron sputtering on a floating substrate in argon-oxygen gas mixtures. We used two unbalanced magnetrons in a closed-field configuration equipped with zirconium targets (100 mm in diameter) driven by a mid-frequency ac power supply producing sinusoidal waveforms of the target voltage and current. The depositions of the films were performed at the repetition frequencies of 38 kHz and 80 kHz, the total pressure close to 1 Pa and the average target power densities in the range of 5 – 15 Wcm^{-2} which are used in industrial ac magnetron sputtering systems. We found that our solution proposed for high-rate reactive sputtering of dielectric films [1, 2], which includes a feed-back pulsed reactive gas flow control and optimized to-substrate reactive gas inlet configuration, is very effective also in industrially-demanded reactive ac magnetron sputtering. The method led to a stable, arc-free sputtering process with enhanced deposition rates of the ZrO_2 films. We will report on deposition characteristics, mechanical and optical properties of the films and their surface morphology.

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Keywords
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