

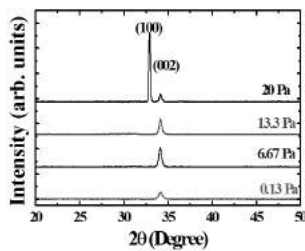
# Effect of Pressure and Temperature on Al-doped Zinc Oxide Thin Films Deposited by Radio Frequency Magnetron Sputtering

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In this paper, we report electrical, optical and structural properties of Al-doped zinc oxide (AZO) thin films deposited at different substrate temperatures and pressures. The films were prepared by radio frequency (RF) magnetron sputtering on glass substrates in argon (Ar) ambient. The X-ray diffraction analysis showed that the AZO films deposited at room temperature (RT) and 20 Pa were mostly oriented along a-axis with preferred orientation along (100) direction. There was an improvement in resistivity ( $3.7 \times 10^{-3} \Omega \cdot \text{cm}$ ) transmittance (95%) at constant substrate temperature (RT) and working pressure (20 Pa) using the Hall-effect measurement system and UV-vis spectroscopy, respectively. Our results have promising applications in low-cost transparent electronics, such as the thin-film solar cells and thin-film transistors due to favourable deposition conditions. Furthermore our film deposition method offers a procedure for preparing highly oriented (100) AZO films.

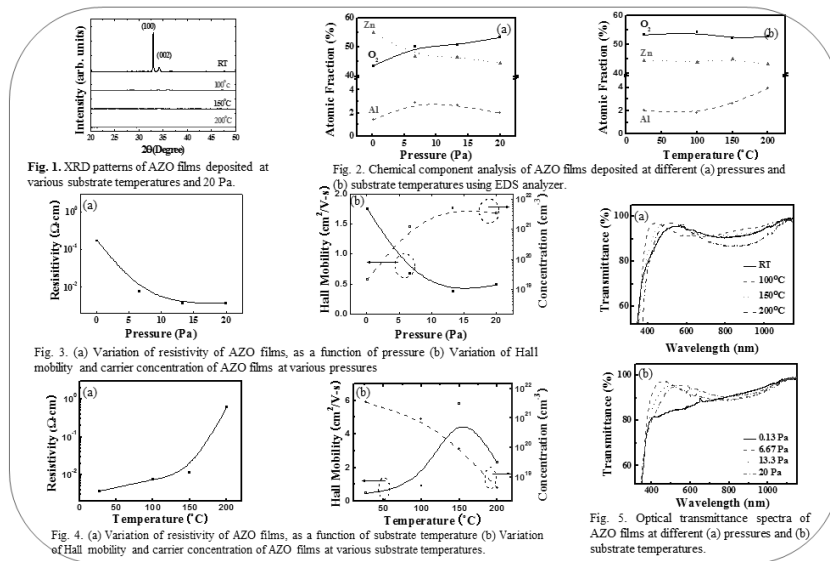
**Keywords:** AZO, RF-magnetron sputtering, XRD



**Fig. 1.** XRD patterns of AZO films deposited at various pressures and RT.

		0.13 Pa	6.67 Pa	13.3 Pa	20 Pa
ZnO (002)	FWHM (deg.)	0.46	0.34	0.32	0.3
	Grain size (nm)	20.9	28	29.7	31.6
ZnO (100)	FWHM (deg.)	-	-	-	0.15
	Grain size (nm)	-	-	-	48.1

**Table I.** The FWHM and Grain size as a function of the pressure variation from 0.13 Pa to 20 Pa.



**Fig. 1.** XRD patterns of AZO films deposited at various substrate temperatures and 20 Pa.

**Fig. 2.** Chemical component analysis of AZO films deposited at different (a) pressures and (b) substrate temperatures using EDS analyzer.

**Fig. 3.** (a) Variation of resistivity of AZO films, as a function of pressure (b) Variation of Hall mobility and carrier concentration of AZO films at various pressures

**Fig. 4.** (a) Variation of resistivity of AZO films, as a function of substrate temperature (b) Variation of Hall mobility and carrier concentration of AZO films at various substrate temperatures.

**Fig. 5.** Optical transmittance spectra of AZO films at different (a) pressures and (b) substrate temperatures.