|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr. No | Input Variables | | | Response Variables | | References |
| Thickness  (nm) | Temperature  (C°) | Bias voltage  (-V) | Residual Stress  ( GPa) | Structure of coatings  (Zone I and combined zone (I & T)) |
| 01 | 1000 | 170 | 50 | 2 | The increment in bias voltage increases the quantity and velocity of ions which are accelerated to the substrate, resulting in columnar structure (combined zone) having higher compressive residual stresses in coating. | [27] |
| 100 | 6.5 |
| 150 | 8 |
| 02 | 220 | 300 | 150 | 5.9 | Decrease in residual stress with increment in thickness may be due to increment of (111) preferred orientation with thickness where strain relaxation occurs in smaller elastic constants (111) reflection. | [12] |
| 750 | 3.1 |
| 1680 | 2.7 |
| 03 | 244 | 400 | 50 | 10.1 | The change in preferred orientation of thin film from (200) to (111) can be attributed to the competition between surface energy and strain energy with increasing film thickness, and (111) preferred orientation is the result of relieving strain energy. | [28] |
| 200 | 9.2 |
| 260 | 8.1 |
| 04 | 400 | 350 | 50 | 2.8 | The decrease in stresses with increase in film thickness is ascribed to the decreased point defects contribution during the initial growth stage to the total residual stress. The higher stresses result from increment of defect density (zone I) caused by argon implantation at higher bias voltage. | [29] |
| 1000 | 1.7 |
| 1500 | 1.2 |
| 500 | 80 | 2.7 |
| 1500 | 1.7 |
| 2000 | 1.4 |
| 05 | 1300 | 190 | 0 | 2.17 | With increase in deposition time, the grains coarsens and porosity decreases, while increasing bias voltage results in finer grain size | [30] |
| 1080 | 40 | 1.6 |
| 1020 | 50 | 1.2 |
| 06 | 1200 | 70 | 0 | 4 | Increment in bias voltage increases ion impinging energy and point defects in the structure of the growing film. The increase in point defects (zone I) can provide more preferential nucleation sites, which may be related to the decrease in grain size. | [31] |
| 1210 | 50 | 6.6 |
| 330 | 100 | 10.2 |
| 07 | 400 | 350 | 50 | 2.7 | With increment of film thickness the zone T structure evolve, the number of grain boundaries decreases, resulting decrease in residual stress. | [32] |
| 1000 | 1.5 |
| 1500 | 1.1 |
| 08 | 200 | 300 | 0 | 2.1 | The compressive residual stress is increased with the increase in bias voltage due to increased energy of ions arriving at the surface of the substrate. | [33] |
| 40 | 5.6 |
| 100 | 7.9 |
| 150 | 12.2 |
| 09 | 283 | 350 | 125 | 2.69 | Decrease in average residual stress with film thickness is due to stress gradient because of decrease in defect density with increase in thickness. | [34] |
| 1335 | 1.35 |
| 1900 | 0.85 |
| 10 | 530 | 350 | 125 | 1.4 | The change in texture cross-over from (200) to (111) reflection at film thickness of 0.5 µm, resulting a decrease in biaxial compressive film stress with increasing thickness. | [35] |
| 1630 | 1 |
| 11 | 250 | 350 | 0 | 2 | Decrease in residual stress with thickness is due to evolutionary growth stages, formation of continuous structure (zone T) and subsequent film growth. | [8] |
| 1000 |  |
| 2000 | 0.9 |
| 750 | 3.1 |
| 1680 | 2.7 |
| 12 | 1500 | 300 | 20 | 2.5 | Increment in bias voltage decreases stress gradient (higher stress at coating/substrate interface and lower near surface) through coating thickness, resulting in an increase in average residual stress. | [36] |
| 100 |  |
| 150 | 5.9 |
| 13 | 1300 | 300 | 20 | 3.9 | Higher kinetic energy of bombarding argon ions with increase in bias voltage results in higher compressive residual stresses. | [37] |
| 65 |  |
| 150 | 6.8 |
| 14 | 1500 | 70 | 40 | 4 | The generation of compressive stresses in thin films has been attributed to particle bombardment induced point defects. As the energy of the bombarding ion is increased, the number of displaced atoms also increases. The coating structure investigated is columnar (zone T). | [38] |
| 100 | 6.9 |
| 150 | 4.5 |
| 15 | 600 | 70 | 0 | 6 | Higher bias voltage can attribute to the bombardment of the thin film by high energy ions, resulting smoother surface having decreased columnar size (combined zone). | [39] |
| 400 | 150 | 7 |
| 16 | 110 | 200 | 0 | 4 | The residual stresses with thickness are generally affected by defect density, change in preferred orientation and densification during layer growth. | [40] |
| 225 |  |
| 360 | 1.7 |
| 17 | 1100 | 300 | 70 | 4.2 | The increase of residual stress was concurrent to the reduction of grain size and disordered mix columnar structure (combine zone), atomic peening mechanism, and grain boundary densification. | [6] |
| 1200 | 3.3 |
| 1500 | 0.7 |
| 18 | 1500 | 300 | 0 | 1.3 | Increment in compressive stresses is related to the increase in bias-voltage which leads to a higher number of defects and lattice distortions. coatings reveal a columnar fibrous morphology (combined zone) resulting in a porous dome shaped. | [7] |
| 100 | 2 |
| 150 | 5.6 |
| 19 | 800 | 200 | 30 | 0.8 | Increment in bias voltage increase the strain energy induced by change in preferred orientation changes from (200) to (111). Being high enough strain energy becomes a driving force for increase in compressive residual stress | [41] |
| 80 | 4.6 |
| 150 | 6.8 |
| 20 | 900 | 300 | 0 | 2.01 | Decrease in residual stress with thickness could be due to annihilation of defect by the temperature, which leads to densification of thin film. Coating exhibits columnar structure (zone T) | [42] |
| 1400 | 1.4 |

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