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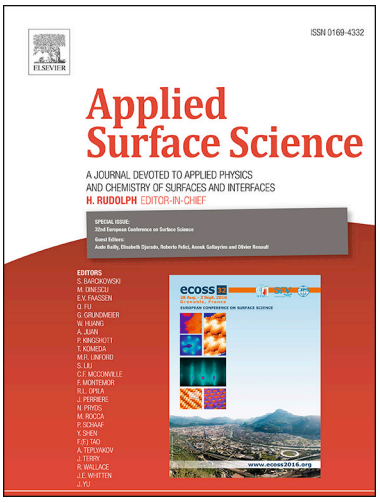

Full Length Article

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Thermodynamic energy variation diagram to speculate preferred growth orientation of magnetron sputtered PbSe thin films on monocrystalline silicon substrates

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ABSTRACT: The optical and photoelectric properties of lead selenide (PbSe) thin films are intensively affected by the thin film crystal structure which is mainly determined by the growth process. In this paper, the growth mechanisms of the magnetron sputtered PbSe thin films on two different monocrystalline silicon substrates (Si(100) and Si(111)) were thermodynamically simulated and experimentally confirmed. The results showed that the growth process of PbSe thin films is mainly affected by the minimization of the interface and strain energy along [200] and [220] crystal orientations, while the surface energy contribution can be neglected. Specifically, the PbSe thin film with [200] and [220] preferred orientation is obtained when the interface and strain energy minimization dominates the growth process, respectively. According to the calculated thermodynamic energy variation diagram, the probability of PbSe thin film grows along [200] orientation on Si(100) substrate is higher than on Si(111), while the probability for [220] orientation is opposite, indicating that the properties of the sputtered PbSe

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