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Abstract The growing interest in plasma processing has motivated recent extensive studies on plasma chemistry, and numerous types of plasma deposition systems are now being used in the electronic industry. This paper reports the deposition of thin silicon nitride films by the relatively new technique of remote plasma chemical vapour deposition. In this method only one of the reacting species (nitrogen) is RF excited and then mixed with dilute neutral silane (4% silane in argon), and the substrate is placed outside the region of RF discharge. Thus damage of the semiconductor surface by particle bombardment is minimized and process parameters are essentially better controlled.

Infrared analysis of plasma deposited silicon nitride films with refractive indexes varying from 1.9 to 2.9 showed the presence of 'N-hydrogen' bonds ($3300\text{--}3350\text{ cm}^{-1}$) and 'Si-hydrogen' bonds ($2100\text{--}2250\text{ cm}^{-1}$). We found that the total concentration of bound hydrogen in the deposited films was about $2\text{--}3 \times 10^{22}\text{ cm}^{-3}$. The films deposited at high concentration of silane contain significant amount of excess silicon.

In this paper we discuss the influence of varying the ratios of reactant gases on the growth rate, refractive index and amount of bonded hydrogen in the deposited films as determined by IR attenuated total reflectance method. The correlation found between annealing conditions for deposited films and their characteristics and the amount of bonded hydrogen are described. It should be noted that damage of gateless GaAs FETs after remote plasma chemical vapour deposition is negligible.