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Exciton Investigations and the Urbach Tails of Gd Doped and Undoped GaSe

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Abstract: Absorption measurements were carried out in GaSe and GaSe:Gd samples in temperature range 10-320 K in steps 10 K. The first and the second (n=1 and n=2) excitonic levels were marked. The first exciton energies for n=1 were calculated as 2.118, 2.008 eV in GaSe, and 2.125, 2.006 eV in GaSe:Gd at 10, 320 K and respectively. The second exciton energies for n=2 were calculated as 2.140, 2.125 eV in GaSe at 10, 80 K and 2.141, 2.120 eV in GaSe:Gd at 10, 120 K and respectively. Binding energies of GaSe and GaSe:Gd were calculated as (29.46\pm 1 and 21.33\pm 1 meV), respectively. The direct band gaps were estimated as 2.147, 2.037 eV in GaSe and 2.146, 2.027 eV in GaSe:Gd at 10, 320 K and respectively. There are abrupt changes in the Urbach energy for GaSe at 100 and 240 K, and GaSe:Gd at 90 and 220 K. However, there are abrupt change both in the steepness parameter for GaSe:Gd at 90, 240 K and in the σ_0 values for GaSe:Gd at 70 and 240 K. These temperatures obtained from the changing of the steepness parameter, σ_0 values and Urbach energy may be at phase transition temperatures.

Key Words: GaSe, GaSe:Gd, exciton, Urbach tails, binding energy, phase transition.

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