5 - 38 Low Energy Heavy Ion Irradiation of Diamond Generates Nitrogen-vacancy Color Centers

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Nitrogen-vacancy (NV) defect center with negative charge in diamond is an important solid-state doping system with wide applications in quantum computing, quantum sensing, and other fields. CVD diamond (nitrogen concentration of 10 ppm) and HPHT diamond (nitrogen concentration of 150 ppm) were irradiated by Ar^{11+} ions with 2.97 MeV, followed by vacuum annealing at 850 ℃ for 1 h. The Raman spectra of the samples were measured. At a high irradiation fluence of $1\times10^{15}/cm^2$, the lattice structure was destroyed and annealing was also difficult to restore the structure, which was not favorable for color center generation. At a lower irradiation fluence of $1\times10^{14}/cm^2$, together with annealing, the ratio of color centers was improved. Exploring experimental conditions such as ion species, irradiation dose, annealing temperature and annealing time is an important guideline for generating high concentration of color centers and single color center (Fig. 1).

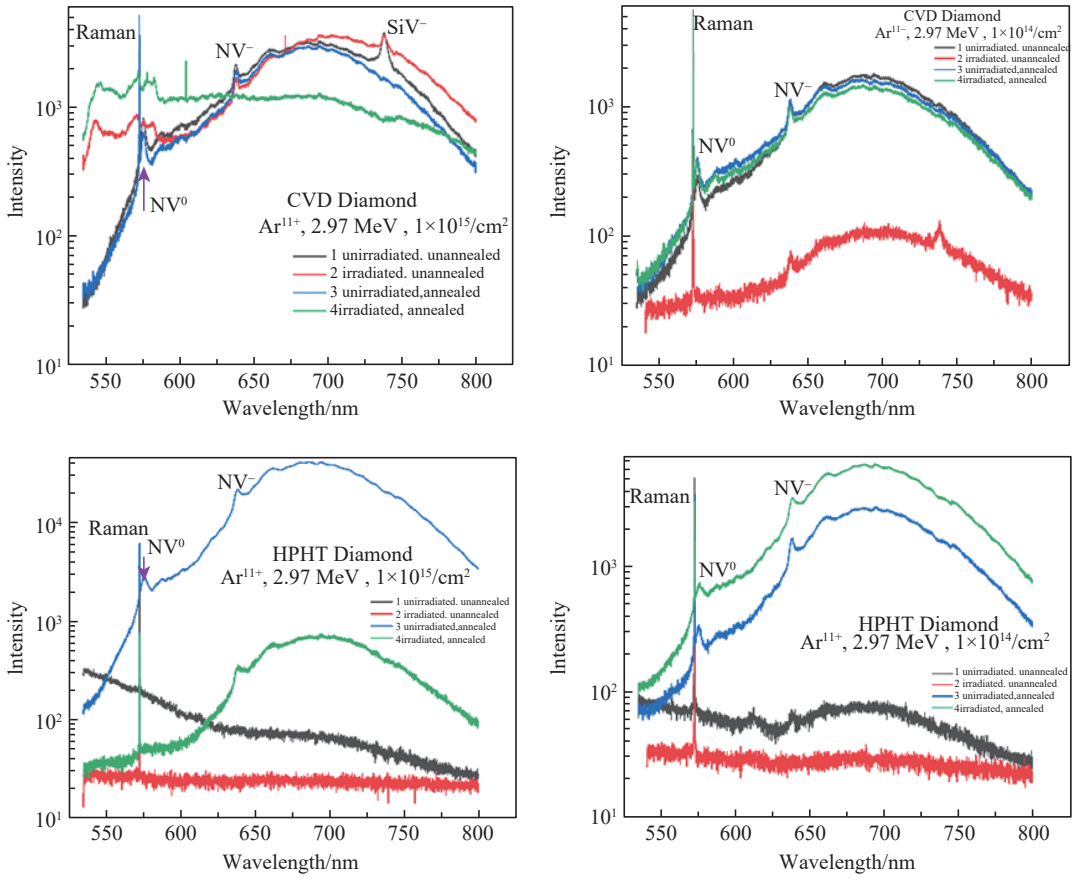

Fig. 1 (color online) Raman spectra of each sample. The Raman peak intensity is weak at high irradiation fluence. The intensity of the color center peak of the HPHT diamond sample was increased at low irradiation fluence with annealing.