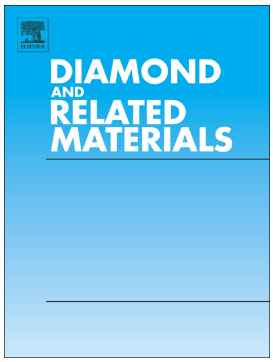

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Optical properties of silicon-vacancy color centers in diamond created by ion implantation and post-annealing

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Abstract:

Silicon-vacancy (SiV) color centers have been created in diamond by ion implantation and post annealing at LABEC (Florence). A wide range of implantation depths (0-2.4 μm) and fluences (10^8-10^{15} cm^{-2}), along with a variety of substrates (single and poly-crystals) have been explored. The photoluminescence properties of the SiV centers have been studied at room temperature, including their single-photon emission characteristics. Single-photon emitters have been obtained at the lower-end of the implantation fluences range. They exhibit a short excited-state lifetime (~1 ns), a strong zero-phonon transition with a narrow linewidth (~1.6 nm) and a very small inhomogeneous broadening (0.015 nm), features that qualify them for application in quantum optical technologies. The activation yield of SiV centers has been assessed under different experimental conditions. It has been found to be independent of the implantation energy and in the range of 3% after thermal annealing.

1 Introduction

Color centers in diamond and other large band-gap semiconductors are promising candidates for the generation, storage and processing of quantum information[1,2,3,4,5], due to the combination of narrow spectral linewidths, high photon emission rates and optically addressable states with long coherence times. Compared to the current alternatives, such as trapped ions[6], nuclear spins[7], superconductive circuits[8] or semiconductor quantum dots[9], they have also the advantage of operating at room (or even higher[10]) temperature. A significant amount of work has been done in