Oglekļa atomu iebūvēšanās ar C^+ joniem implantētos silīcija dioksīda stiklos

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Nevēlami oglekļa piemaisījumi tīros SiO_2 stiklos iekļūst no silīcijorganiskām izejvielām vai stiklu kausējot. Stikli ar lielām C koncentrācijām –silīcija oksikarbīdu stikli ir daudz pētīti, ogleklis tur bieži veido agregātus, piem., nanodaļiņas. Turpretim atsevišķu C atomu iebūvēšanās SiO_2 stiklos nav labi izprasta. Darbā ir pētīti stikli, leģēti ar jonu implantācijas metodi (50keV, 1×10^{15} – 3×10^{16} C^+/cm^{-2}). Kontrolei tika pētīti līdzīgi ar ekvivalentām Ne^+ dozām implantēti paraugi. Optiskās absorbcijas spektros visos paraugos inducējas divalento Si ("SiODC") josla pie 248 nm, tā ir relatīvi lielāka C+-implantētos paraugos. IR absorbcijas spektros C+-implantētos paraugos parādās jauna 2339 cm^{-1} josla, kas norāda uz starpmezglu CO_2 molekulu rašanos. Pie lielākajām dozām parādās papildus josla, saistīta ar starpmezglu CO molekulām. Šo molekulu koncentrācija ir daži % no implantētajiem C joniem. EPR spektros novērojams ar oglekli saistīts signāls ar g=2.0028, kas ir līdzīgs literatūrā ziņotajam virsmas centra, oglekļa radikāļa $(\text{-O-Si})_3C^\bullet$ signālam. Fotoluminiscences spektros ir novērojamas pašvielas defektu joslas, un papildus ar oglekli saistīta zaļa luminiscences josla pie 580 nm. Atbilstošā centra struktūra pašlaik vēl nav zināma.

Incorporation of carbon in C^+ ion-implanted silica glass

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Undesired carbon impurities can enter high-purity silica glass during synthesis from organic precursors or from glass melting environment. SiO_2 glasses with large carbon concentrations (silicon oxycarbide glasses) have been extensively studied. Formation of C nanoparticles and other multiple C-atom configurations is often assumed. In contrast, the effects of low-concentrations of carbon dopants and the pattern of single carbon atom incorporation in SiO_2 glass network is still not well-understood.
Properties of C atoms, introduced in silica by 50 keV C^+ ion implantation at doses 1×10^{15} – 3×10^{16} ions/cm^{-2} were studied. To separate chemical effects and radiation damage, samples implanted by equivalent doses of Ne^+ ions were used. Optical absorption spectra of all samples show creation of divalent Si atoms ("SiODC"). It is relatively more intense in C-implanted samples. IR absorption spectra of C-implanted samples reveal a new band at 2339 cm^{-1}, which is due to interstitial CO_2 molecules. At highest doses another IR band, which can be assigned to CO molecules appear. Their concentration is few% of the implanted C ions. EPR spectra of C-implanted glass show signal with g=2.0028, reminiscent of previously reported carbon-related surface radicals $(\text{-O-Si})_3C^\bullet$. Photoluminescence spectra reveal the usual bands due to SiODC and oxygen dangling bonds. Additionally, a green emission band at 580 nm, appears, which can be assigned to carbon impurity center. Its structure is presently not yet known.

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