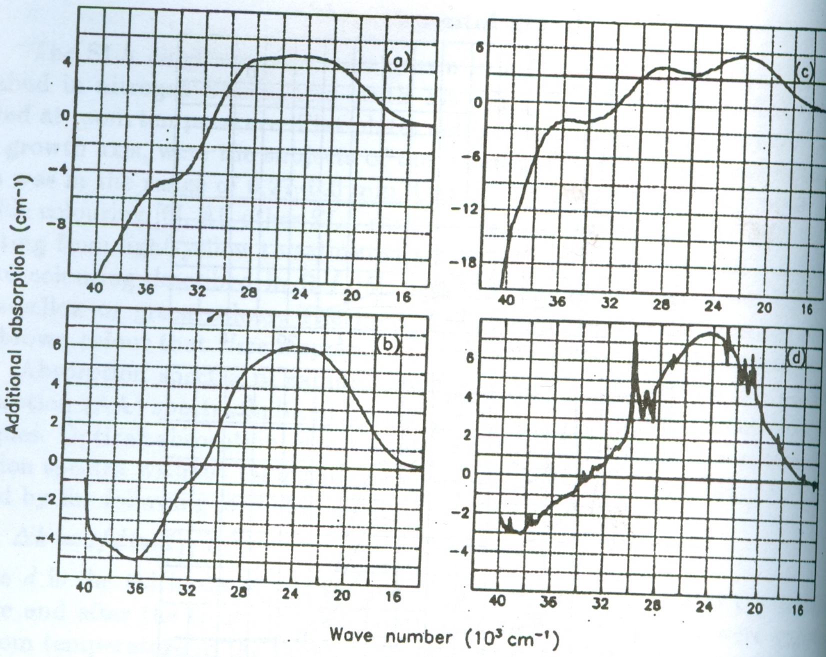

Fig. 2. The additional absorption spectra induced by gamma-irradiation in the SLA crystals of the first group (a) and the second one (b), in the SLG crystal (c) and in the CaNdAlO$_4$ crystal (d).

in Fig. 2a) and the second one (32000 and 36000 cm^{-1} in Fig. 2b). In the regio of induced absorption of the samples of the first group two bands with maxima at 22000–23000 cm^{-1} and 28000 cm^{-1} can be distinguished (Fig. 2a). The induced AA of the samples of the second group is placed in the same region but it has no clear structure. Its maximum is located near 24000 cm^{-1}, but on the short-wave slope of the band the weakly marked shoulder is observed (Fig. 2b) associated perhaps with the band at 28000 cm^{-1}.

The AA spectrum induced in yellow SLG crystal by the gamma-irradiation of the 10^3 Gy dose is pictured in Fig. 2c. They contain a clearing part in the short-wave region and two bands with maxima near 28000 and 24000 cm^{-1}. In the short-wave clearing region the spectral absorption bands with maxima at 3350 and 38000 cm^{-1} are clearly seen. The long-wave part of the spectrum remains almost invariable with a dose increase up to 10^6 Gy. The behaviour of absorption near FAE is not so clear due to its much higher value and as a consequence a much lower accuracy of measurements. The large absorption of green samples in UV region of spectrum has not allowed to obtain an AA spectrum with a clear structure.

For comparison the AA spectrum of CaNdAlO$_4$ single crystal irradiated by gamma-quanta with a dose of 10^5 Gy is shown in Fig. 2d. Although the corresponding curve has a series of distortions caused by the presence of a lot of narrow intense $f-f$ transition lines of the Nd ion, one can see in the figure that changes of spectra of $CaNdAlO_4$, SLA and SLG crystals induced by irradiation have the same character and, it seems, the same origin.

4. Discussion and conclusions

Colouring in SLA and SLG single crystals is accompanied by the appearance of a signal in the ESR spectrum (D-line) [5, 7]. Its intensity increases with the colouring saturation in the following range of colours: colourless, light-yellow, yellow, green, dark-green [5]. But the simultaneously observed signal, caused by iron impurities, remains approximately the same. An addition of 1.5×10^{-2} wt.% Fe-impurity into a melt decreases the D-line intensity. In Ref. [7] it was mentioned that the D-line is also observed in the ESR spectrum of $CaNdAlO_4$ crystal, although this crystal did not reveal any detectable ESR signal of the Fe-impurity. From these results a conclusion was reached that colouring of the SLA and SLG crystals is connected with the rise of oxygen defects during the crystal growth process [5]. This seems to be quite probable because of the insignificant difference between Sr and La ion radii (0.113 and 0.115 nm, respectively) which, due to a small variation of the temperature gradient, may easily cause a local disorder in the distribution of two- and three-valent ions in the crystal structure [8] and in consequence leads to the appearance of oxygen defects.

The comparison of absorption spectra of the SLA and SLG crystals as well as the AA spectra shows that many of their absorption bands coincide and therefore the colour centres in these crystals may have the same nature. On the other hand the gamma-irradiation in the absorbed dose range up to 10^7 Gy causes usually the defect recharge processes in oxide crystals [9]. The saturation of induced changes is an evidence of that. Then the comparison of the AA spectra induced by the gamma-irradiation in the SLA, SLG and $CaNdAlO_4$ single crystals (which are very similar too) allows us to suggest that those defects are the oxygen related ones. In this sense the presented results coincide with the previously obtained ones.

But it should be noted that the segregation-like red-brown regions observed in green SLG crystals may be connected with the iron impurity. The corresponding absorption manifests itself mainly by a tail in the region of 22000–18000 cm^{-1}. The absorption near 20000 cm^{-1} was also observed in the SLA crystals of the second group and was clearly distinguished as a spectral band in thermal changes of their spectra [6]. If it is so then the difference between the SLA crystals of the first and second group, that was found in spectral positions of the characteristic defects' bands and absorption behaviour under thermal treatment in Ref. [6], might be explained as a mutual influence of defects related to Fe-impurity and oxygen sites. The reducing of intensity of D-line with iron doping [5] indicates this fact too.

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