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IR spectral analysis for the diagnostics of crust earthquake precursors

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In regions of future earthquakes, a few days before the seismic shock, the emanation of radon and hydrogen is being observed, which causes clouds of increased ionisation in the atmosphere. In the present work the possible diagnostics of these clouds using infrared (IR) spectroscopy is considered, which may be important and useful for the general geophysical system of earthquake prediction and the observation of industrial emissions of radioactive materials into the atmosphere.

Some possible physical processes are analysed, which cause, under the condition of additional ionisation in a pre-breakdown electrical field, emissions in the IR interval. In doing so, the transparency region of the IR spectrum at wavelengths of 7-15 μm is taken into account. This transparency region corresponds to spectral lines of small atmospheric constituents like CH_4, CO_2, N_2O, NO_2, NO, and O_3. The possible intensities of the IR emissions observable in laboratories and in nature are estimated. The acceleration process of the electrons in the pre-breakdown electrical field before its adhesion to the molecules is analysed.

The laboratory equipment for the investigation of the IR absorption spectrum is constructed for the cases of normal and decreased atmospheric pressures. The syntheses of ozone and nitrous oxides are performed in the barrier discharge. It is studied if the products of the syntheses may be used to model atmospheric processes where these components take part. Spectra of products of the syntheses in the wavelength region of 2-10 μm are observed and analysed. A device is created for the syntheses and accumulation of nitrous oxides. Experiments to observe the IR-spectra of ozone and nitrous oxides during the syntheses and during the further evolution of these molecules are performed.

For the earthquake prediction, practically, the investigation of emission spectra is most important, but during the laboratory experiments, the radiation of the excited molecules is shifted by a time interval which is larger than the duration of the barrier discharge and lasts until a noticeable, measurable heating of the chamber occurs. Thus the modification of the laboratory equipment to measure emission spectra is a special task. Besides the working volume of the chamber has to be enlarged considerably.