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# INFRARED SPECTRAL INVESTIGATION OF ORGANOSILICON COMPOUNDS UNDER CORONA CHARGE INJECTION IN AIR AT ATMOSPHERIC PRESSURE

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The changes in the chemical structure of an organosilicon compound generated in a wire-to-plane corona discharge electrode configuration in air at atmospheric pressure are investigated by infrared spectral measurements. A comparison between the compounds obtained in negative and positive corona discharges, is made.

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*Keywords*: Corona discharge, Silicone oil, IR measurements

## 1. Introduction

Corona discharges are widely used for new chemical bonds generation at the dielectric material surfaces in order to improve their certain proprieties.

In this paper, we investigate by infrared (IR) spectral measurements the changes in the chemical structure of an organosilicon compound in a wire-to-plane corona discharge electrode configuration at atmospheric pressure in both electrode polarities.

## 2. Experimental set-up

The experimental set-up is schematically presented in Fig. 1.

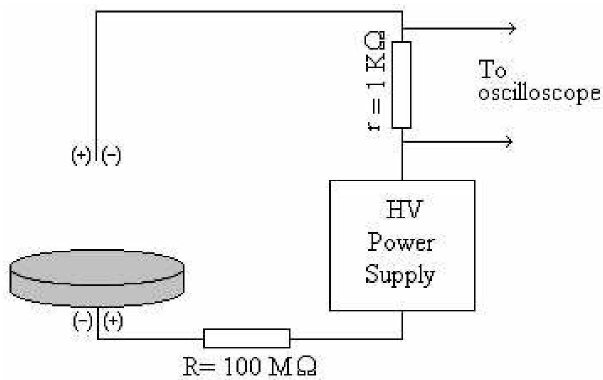


Fig. 1. Experimental set-up.

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The corona discharge electrode configuration is of wire-to-plane type. The copper wire with a 0.1 mm diameter and 40 mm length is placed in air at atmospheric pressure above a germanium disk, with 22 mm diameter, at 8 mm interelectrodic gap. A d.c. 24 kV is applied on the electrodes through a resistor of 100 MΩ. The temporal evolution of the current discharge in both positive and negative corona discharges was visualized on a Tektronics 320 oscilloscope. The chemical structure modifications of an organosilicon compound (silicone oil) generated by corona charged particles are investigated by IR spectral measurements using an IR 75 Specord spectrophotometer with 5 $cm^{-1}$ resolution.

## 3. Results and discussions

A silicone oil drop of tens of $\mu m^3$ is stretched in a thin layer on a germanium support under negative and positive corona charge injection [1], on a surface with a diameter of about 6 mm. The IR spectrum of the investigated silicone oil is presented in Fig. 2. The band identification [2] is also shown in the figure below.

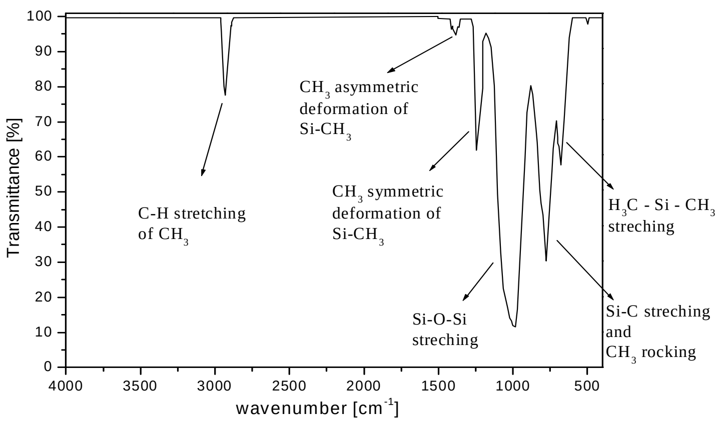


Fig. 2. The IR spectrum of the silicone oil.

The negative corona discharge current is presented in Fig. 3 where it can be seen that the Trichel pulses are accompanied by a permanent current. In positive corona discharge, the current is continuous one, having the same value as that of permanent current of negative corona discharge (10 $\mu$A).

In negative corona discharge the excitation and ionization processes of the air take place in a very shallow glow layer around the tip. Outside of this region, the electrons and negative ions of oxygen drift to the anode attain the free surface of the oil breaking and respectively generating new chemical bonds.

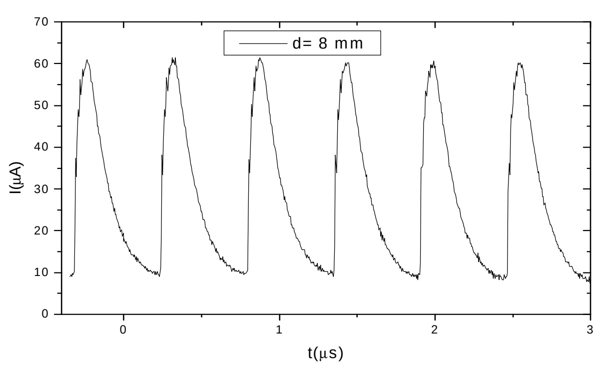


Fig. 3. The waveform of the negative corona discharge current.

After 2 hours of negative corona charge injection at the free surface of the silicone oil, in the IR spectrum, Fig. 4a, we observed that the C-H bonds are broken, the Si-C bonds are diminished, and new bonds of Si-O, due to the electrical attachment of negative oxygen ions, are formed. The vibrations of these new chemical bonds are identified in the spectrum at ~ 800 $cm^{-1}$ [2]. The intensity of this band increases with the amount of charge injection at the free surface of the new organosilicon compound as it can be seen in the Fig. 4b.

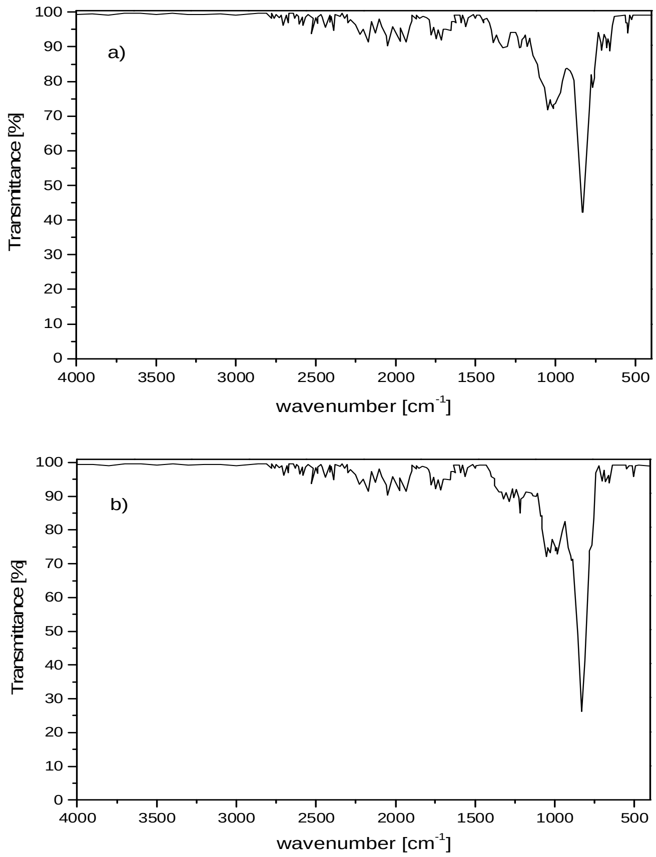


Fig. 4. The IR spectrum of the silicone oil after a) 2 hours and b) 4 hours of negative corona charge injection.

In the case of the positive corona discharge the positive ions of $N_2^+$, $O_2^+$ break all C-H and Si-C bonds of the silicone oil, the Si-O-Si bonds remaining unaltered [3]. After two hours of corona charge injection the obtained IR spectrum presents only the vibration band assigned to Si-O-Si bond stretching. This IR spectrum is identified as IR spectrum of an amorphous $SiO_2$ compound [4].

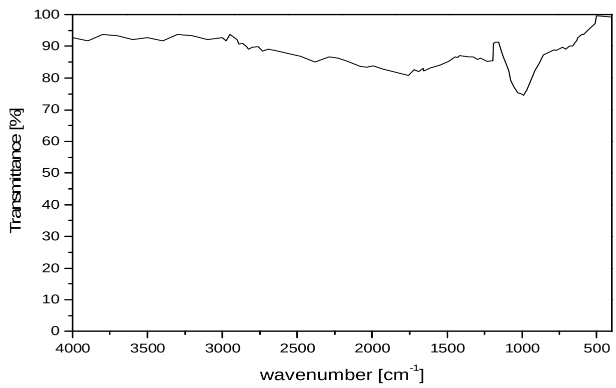


Fig. 5. The IR spectrum of the amorphous $SiO_2$.

## 4. Conclusions

In this paper, we report the possibility of a new silicon based compounds generation in a corona discharge in air at atmospheric pressure in both electrode polarities, using a silicone oil as precursor.

**Acknowledgments**

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## References

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