

thin layer of dielectric between the electrodes and the substance is inserted. It occurs because the lines of the electric field close in dielectric and only few penetrate to the substance investigated. The modelling results clearly show that the dielectric has to be as thin as possible.

The Fig. 8 shows the dependence of impedance on thickness of the electrodes. The modelling conditions were: the width of electrodes – 2 mm and the gap between electrodes – 4 mm.

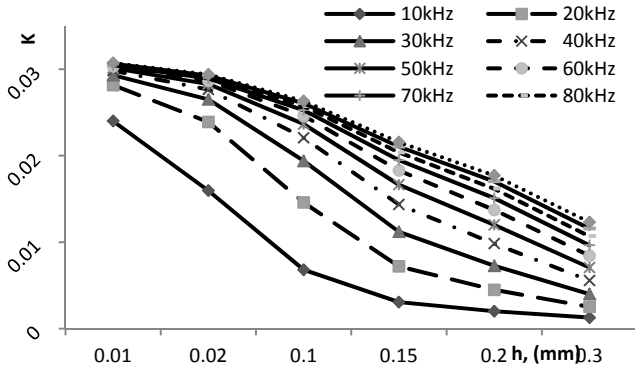


Fig. 7. The impedance dependence on the thickness of the dielectric layer and frequency.

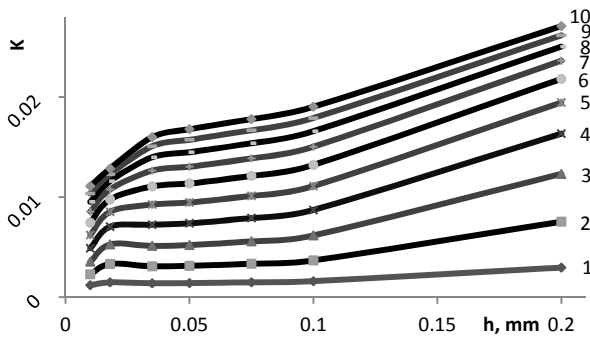


Fig. 8. The impedance dependence on the thickness of electrodes and frequency.(1-10kHz, 2-20kHz, 3-30kHz, 4-40kHz, 5-50kHz, 6-60kHz, 7-70kHz, 8-80kHz, 9-90kHz, 10-100kHz).

As can be seen from Fig. 8, the thickness of the electrodes should be minimal, because it assures higher ratio K.

In order to determine minimal thickness of the sample theoretical impedance dependence on thickness of soil sample was investigated (Fig. 9). The investigation was carried out in two cases: the first was performed when the width of electrodes $a=2$ mm and the gap between them $b=0.5$ mm ($2/0.5=4$), and the second was performed when the width of electrodes $a=2$ mm and the gap between them $b=10$ mm ($2/10=0.2$).

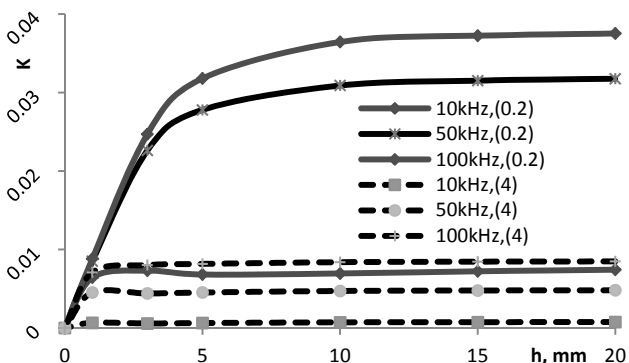


Fig. 9. The impedance dependence on the thickness of sample of soil and frequency.

It was established that the thickness of sample should be at least 10–15 mm, otherwise the most of electric field lines bypass the sample.

The impedance of the sensor depends on the thickness of sample nonlinearly up to a certain limit and after that the thickness does not affect this parameter.

In order to achieve optimal size of the electrode system it is important to determine the optimal gap between electrodes and the width of the electrodes should be acceptable comparing to the thickness of the substance sample.

IV. CONCLUSIONS

The modelling in the frequency range from 10 kHz to 100 kHz using COMSOL Multiphysics proved that influence of relative permittivity and conductivity of soil on impedance of interdigital sensor can be determined

In order to achieve higher sensitivity, the electrodes have to be as thick and narrow as possible and the thickness of dielectric between sample and the electrodes should be minimal.

The bigger gap between electrodes ensures the higher measurement accuracy.

The influence of the type and salinity of the soil on impedance of sensor should be determined experimentally.

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