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Abstract

This paper demonstrates variable frequency microwave processing of silver nanoparticles inkjetprinted onto polyethylene terephthalate (PET) substrate. Printed patterns were in situ monitored with the use of a camera and specially developed two-color infrared pyrometer. It was demonstrated that direct microwave heating of metal inks is very challenging to control due to the progressive evaporation of polar solvents, and almost always leads to non-uniform heating and significant sample deformation. To overcome this difficulty, a PET-based substrate with a solvent-absorbing layer was used. Samples were analyzed at various heating periods and microwave power levels. The collected results reveal a sharp increase in the temperature at the very first moment of the microwave irradiation caused by concomitant interaction with electric and magnetic fields. Depending on the processing conditions, the sintered samples achieved relatively low electrical resistances at the very beginning of the irradiation periods. The lowest measured resistivity was about 30 $\mu\Omega$ cm after only 5 s of irradiation. Microstructural analysis of the film revealed inter-particle neck formation and no significant grain growth. The observed reduction in the electrical resistivity upon microwave irradiation was mainly ascribed to the neck formation and its progressive growth.