

Microwave Techniques to Differentiate the Types of Carbon

Fatma Shkal, Julian Steer, and Adrian Porch
Cardiff School of Engineering

Outline

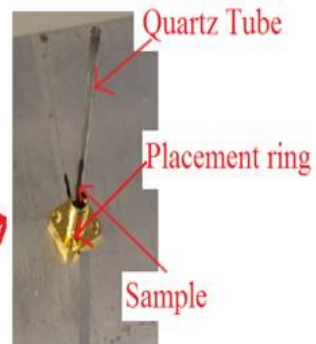
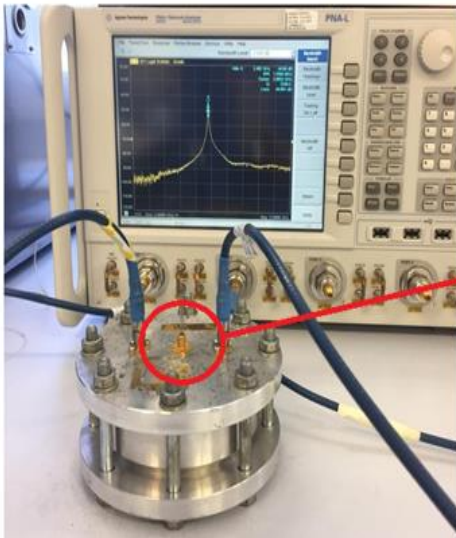
- Objectives
- Techniques
- Materials
- Findings
- Conclusions

Objectives

- Microwave systems for differentiation carbon materials In BFD.
- Frequency-dependent dielectric properties of carbon materials In BFD.
- Temperature-dependent dielectric properties of carbon materials In BFD.

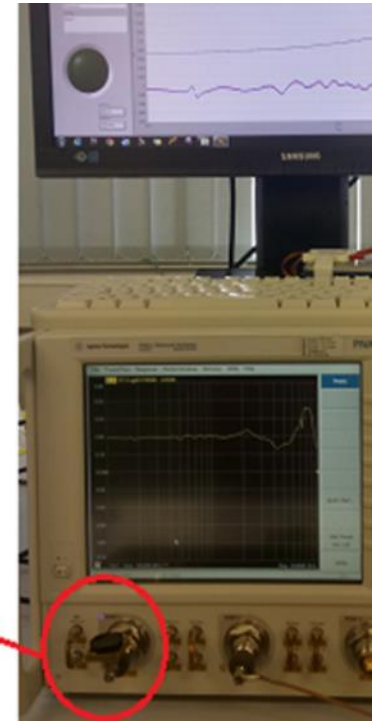
Techniques

Microwave cavity system



Broadband coaxial probe

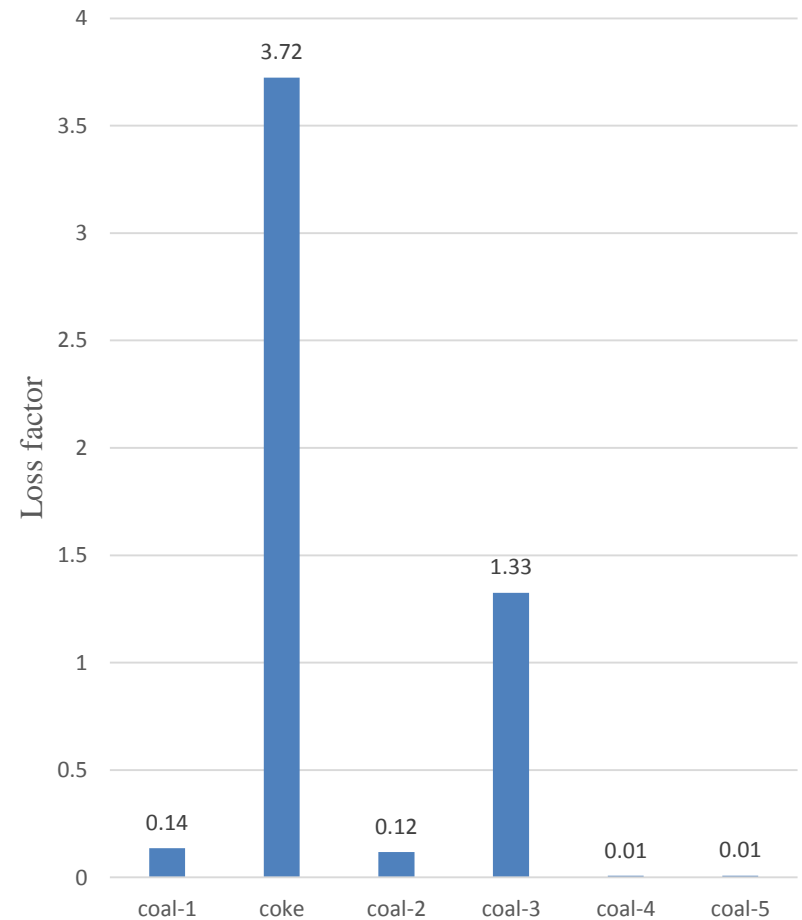
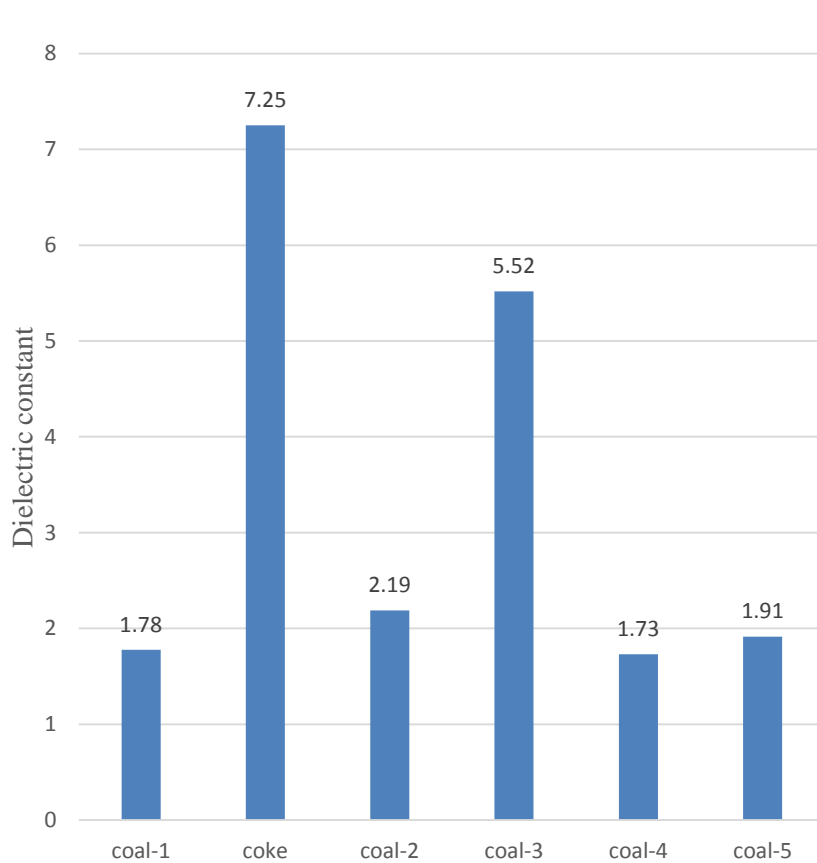
Carbon/Silicone Rubber sample



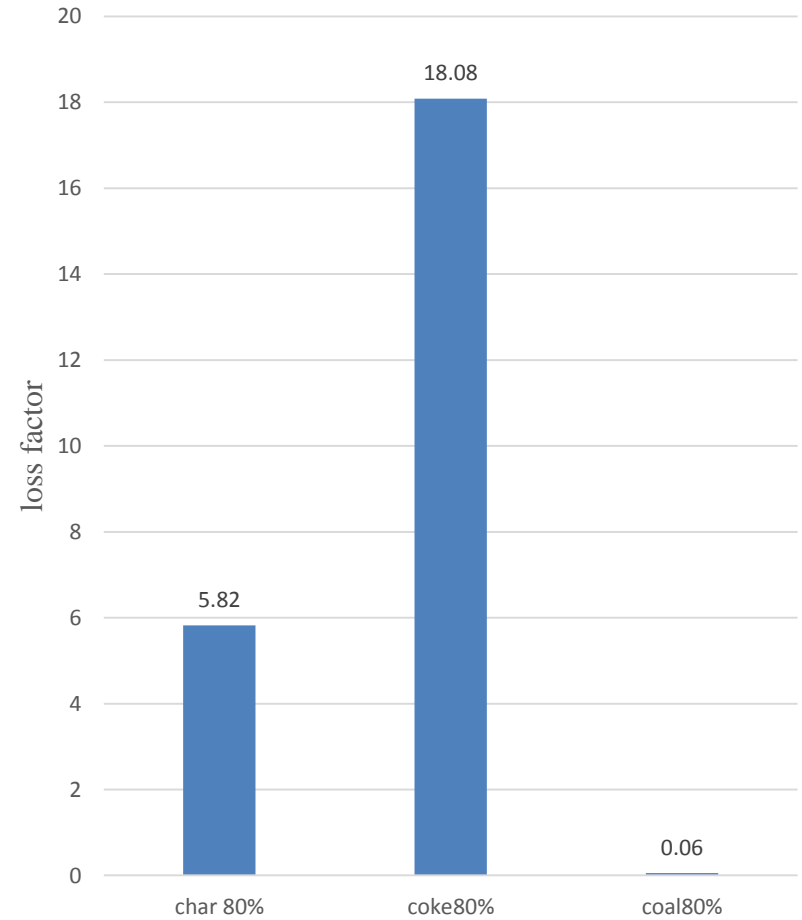
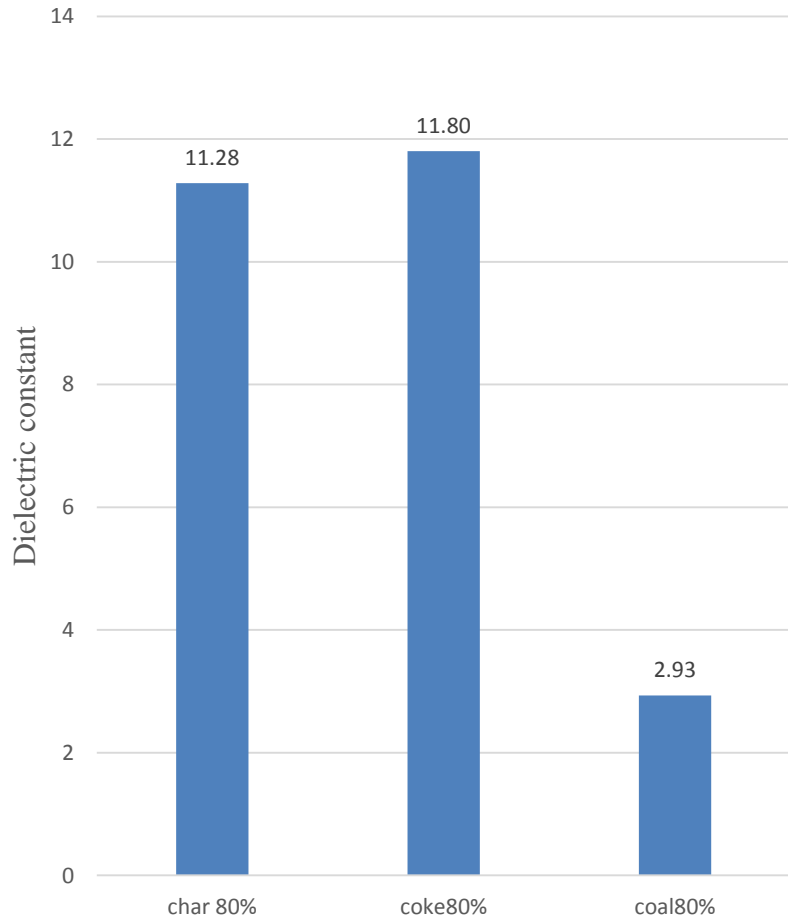
Materials

- Carbons in blast furnace dust, such as coke, coal or partially burnt chars.
- size classification.
- oxygen: carbon ratio.
- residence time of oxygen

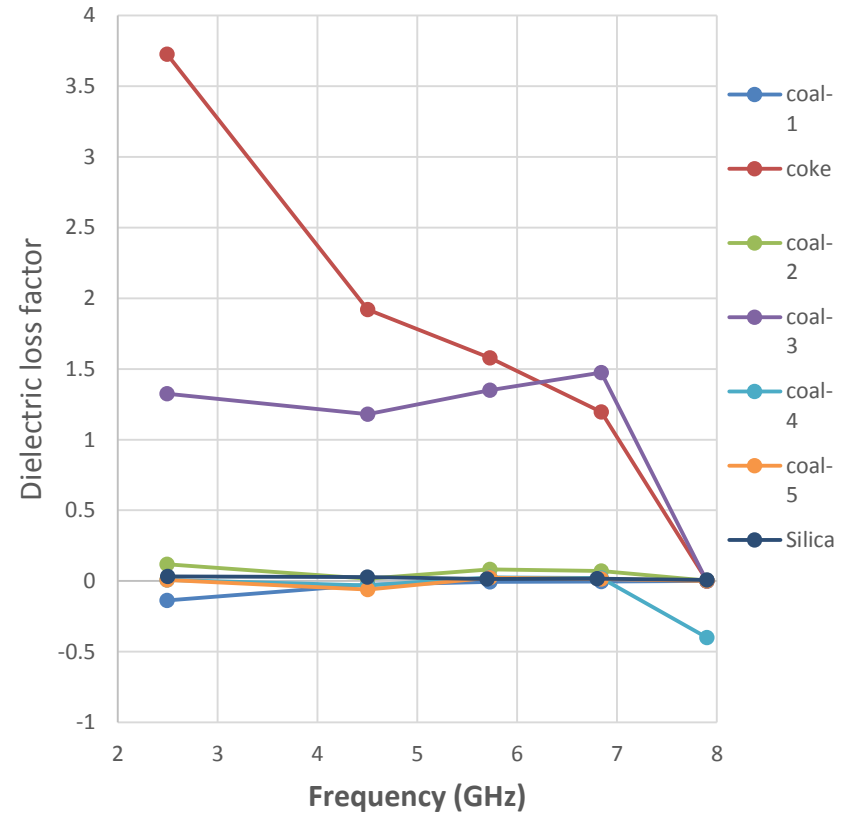
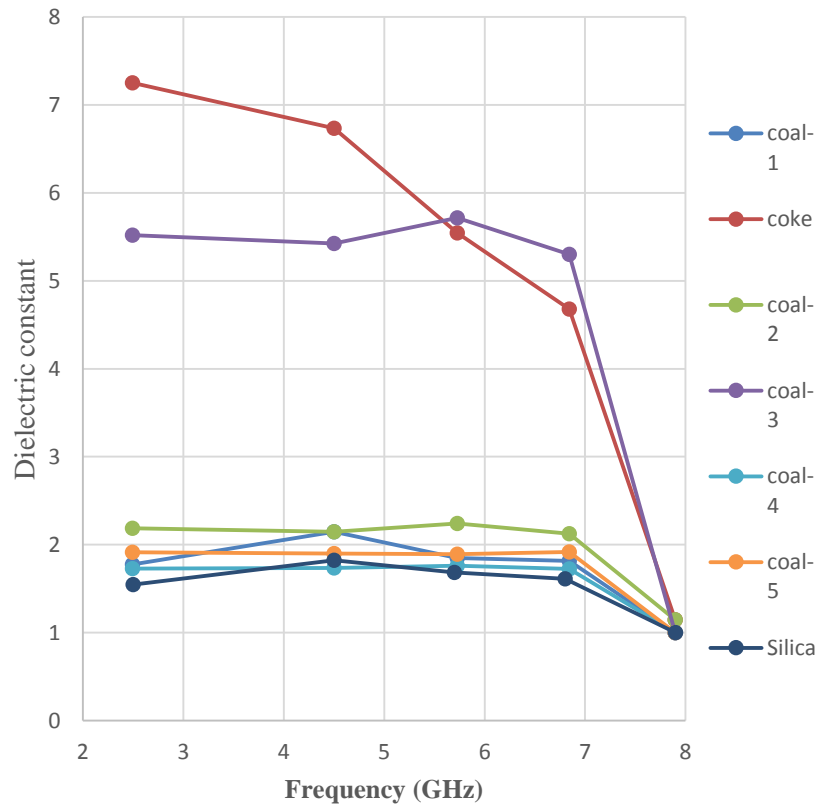
Findings: carbons contained in BFD



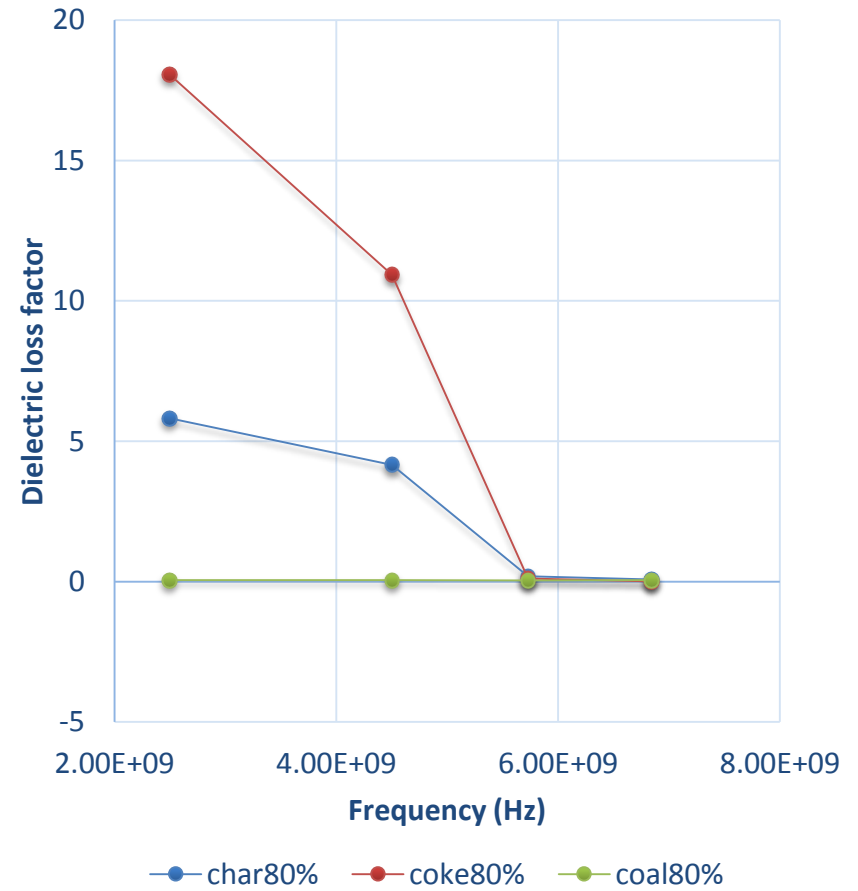
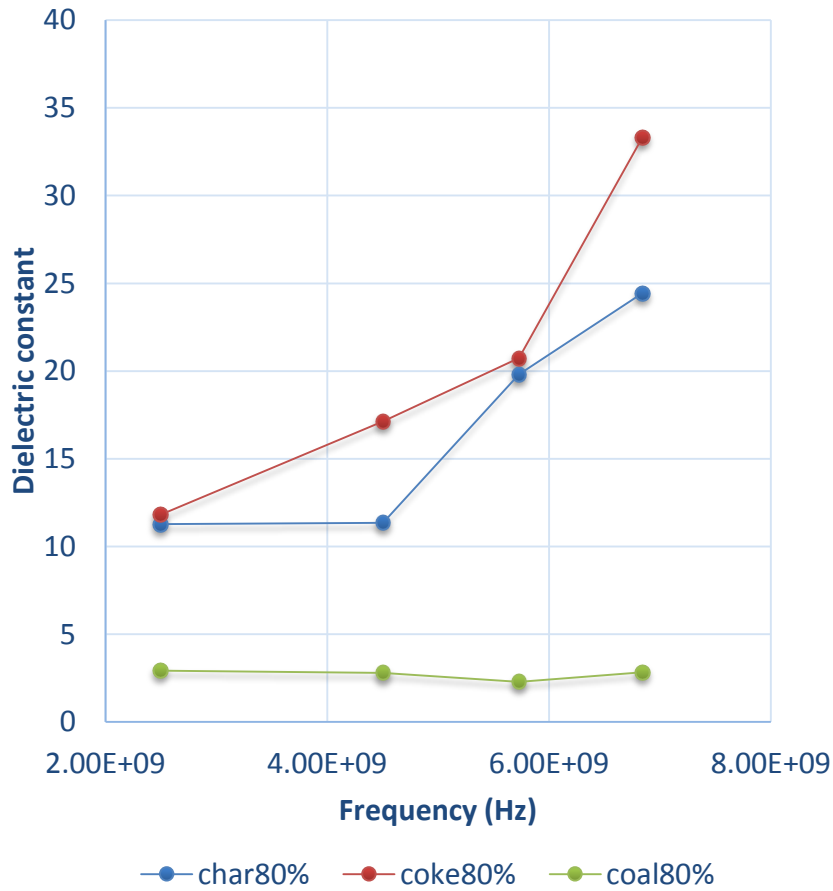
Findings: lab-made samples



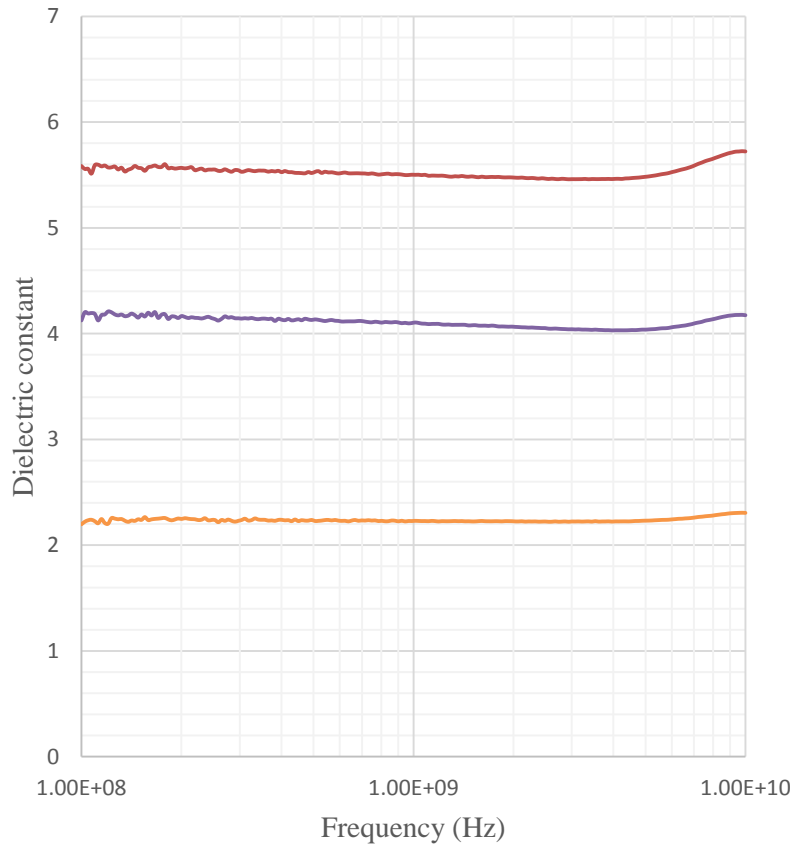
Findings: multimode cavity measurements



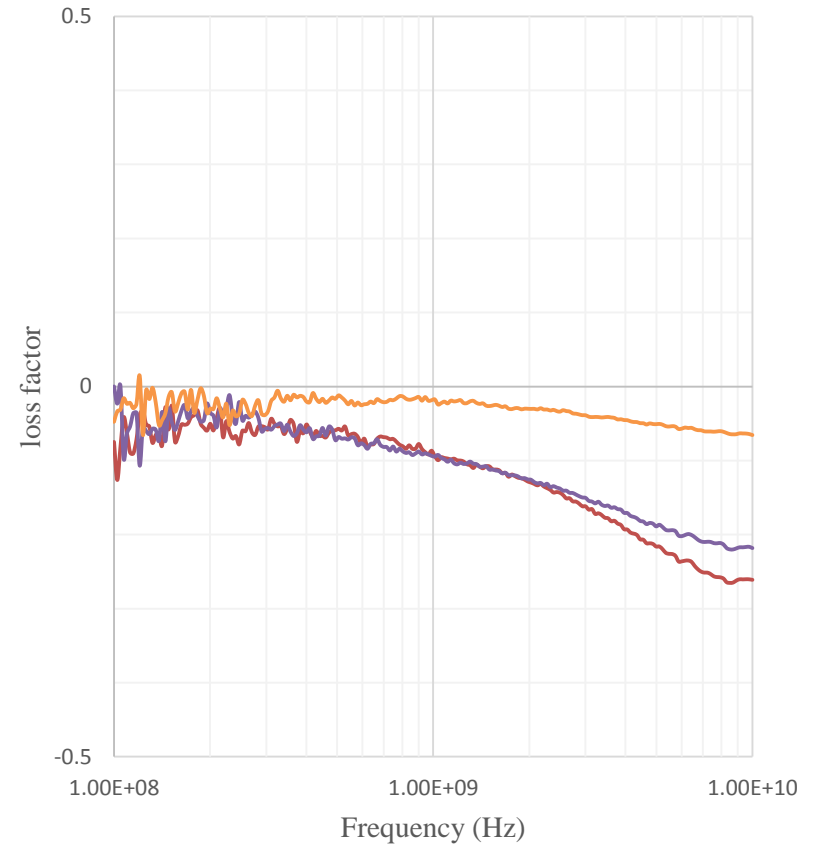
Findings: multimode cavity measurements



Findings: Broadband coaxial probe

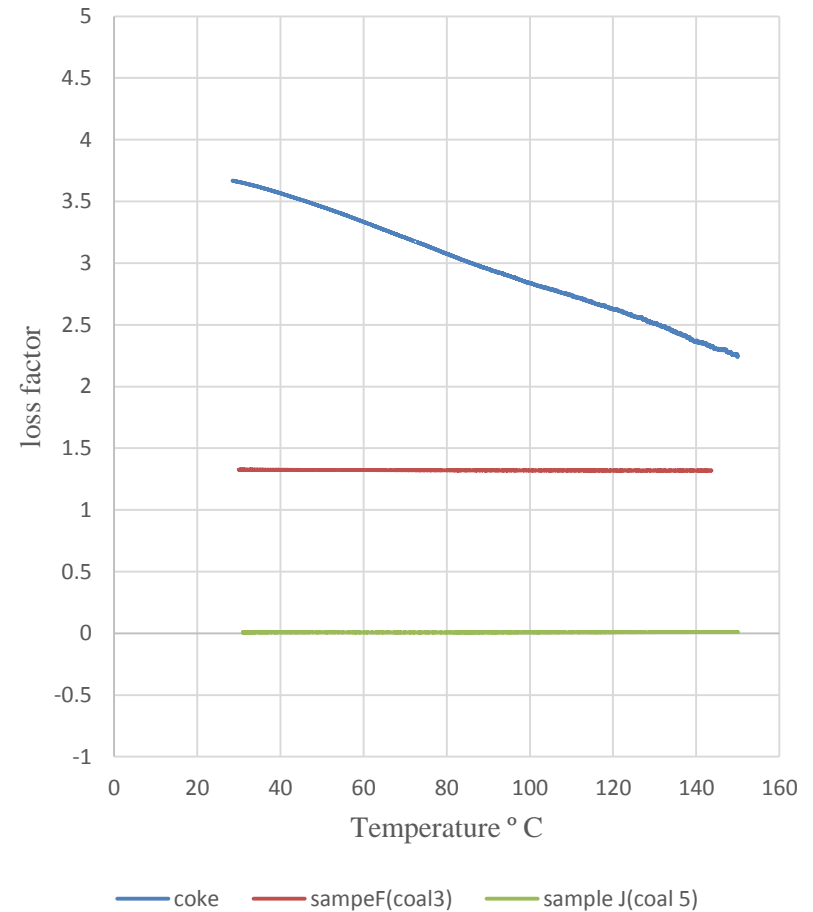
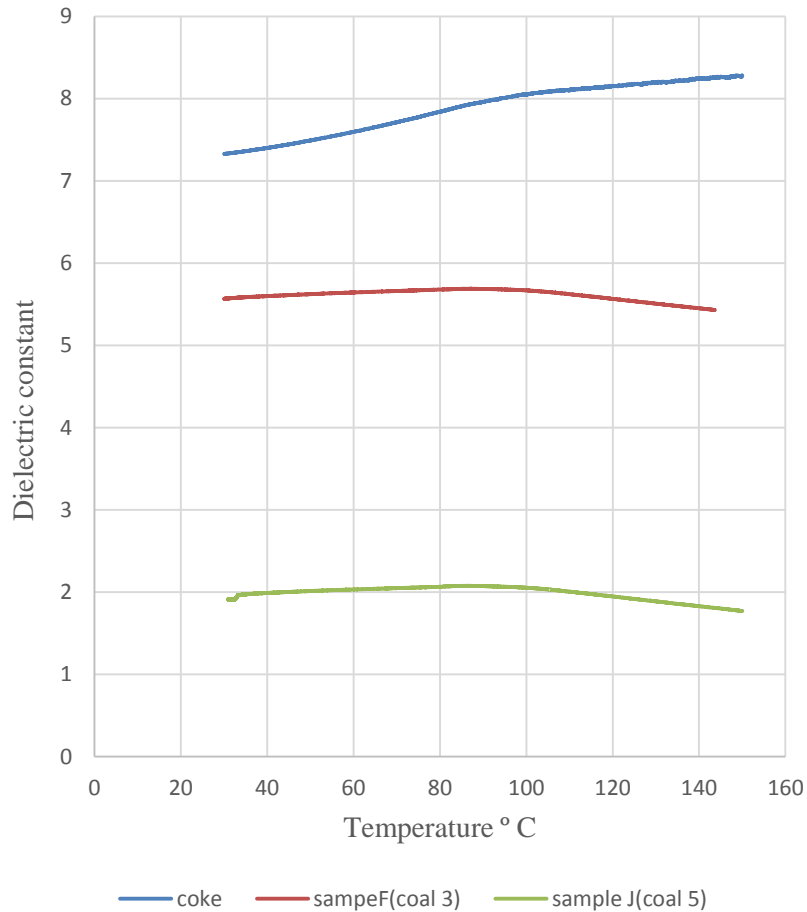


— coke — coal3 — coal5



— coke — coal3 — coal5

Findings: Broadband coaxial probe



Conclusions

- Multimode cavity and open-ended coaxial probe methods are appropriate to be used as test methods for identifying and differentiating the carbon materials based on the frequency dependence of their dielectric properties.
- Microwave methods are sufficient to differentiate carbon materials by measuring the complex permittivity under different temperature conditions.

Thank You