# A wireless W-band 3D-printed temperature sensor operating beyond 1000 °C

## Supplementary information

## Contents

# 1 3D photonic crystal dimensions

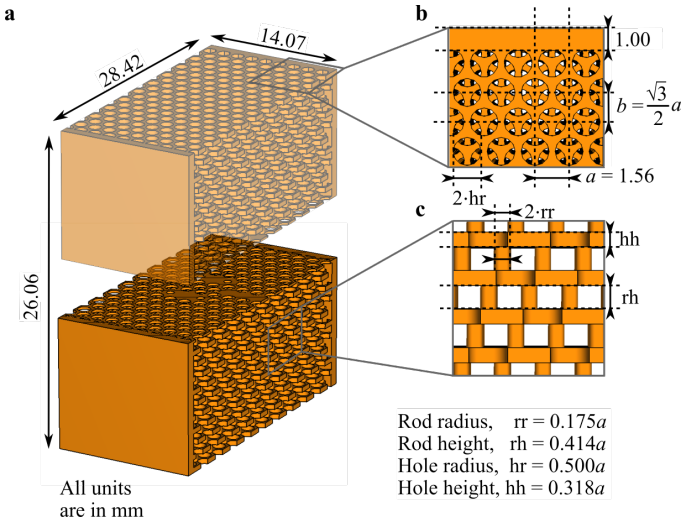


**Fig. 1 Dimensions of the 3D photonic crystal structure. (a)** Overall dimensions. **(b)** Upper view, with the lattice constant $a$ marked. **(c)** Side view of the photonic crystal.

## 2 Setup for temperature measurements

The measurement setup employed for the temperature measurements is presented in Fig. 2. The sensor - formed by the 3D photonic crystal with the flattened lens on top - was placed inside the furnace. A fan was added for cooling, as it was found that the springs holding the furnace's door closed softened up after approximately 1000 °C. This implied that the door opened slightly, which could potentially heat up the measuring antenna. The effectivity of the fan on keeping the measurement equipment at room temperature was confirmed via multiple measurements with a thermal camera.

For automatic measurements, voltage out of the furnace's thermopar was measured with a voltmeter, and the temperature was estimated by reading out the corresponding voltage and comparing it to calibration curves of voltage versus temperature previously established. MATLAB was used to automatize the process.

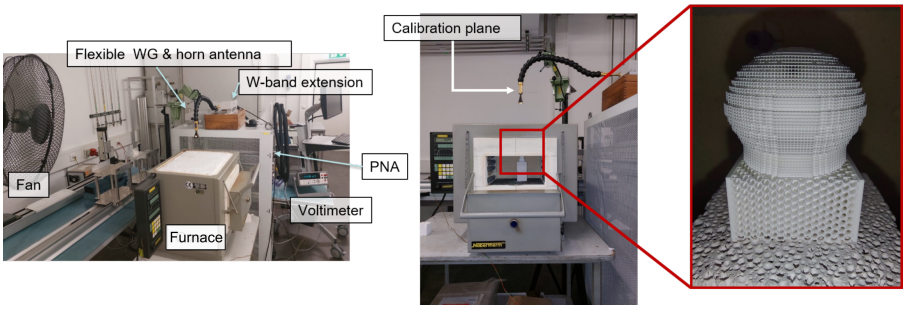


**Fig. 2 Setup for the temperature measurements. (a)** Picture showing the whole measurement setup from far away. **(b)** Close-up showing the sensor inside the furnace and marking the calibration plane that was employed, to remove the effect of the flexible W-band waveguide. **(c)** Close-up to the sensor itself, showing that the lens is placed on top, and centred, on the photonic crystal.