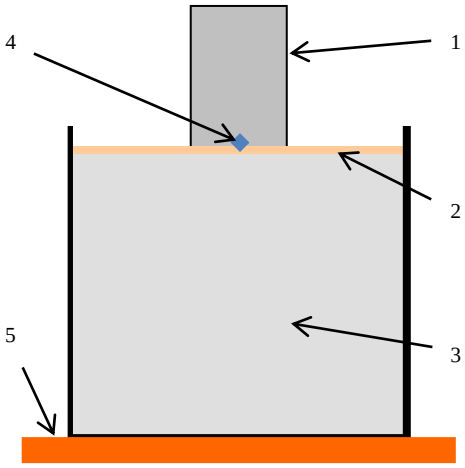
National Physical Laboratory

Tissue phantom for assessment of surface temperature of an ultrasonic transducer

Schematic diagram of a typical setup to measure surface temperature



1. Ultrasonic transducer under test
2. Silicone skin-mimic (0.5 to 1.5 mm)
3. Agar tissue-mimicking material (TMM)
4. Thermal sensor (thermocouple)
5. Acoustic absorber

Note: Thermal sensor and acoustic absorber are not included as part of this phantom

Specifications

The TMM complies with the specification given in clause 11 of IEC 60601-2-37 Ed 2, and is prepared following guidelines given in Annex DD of the same standard.

Maintenance

The TMM should be stored in the closed container under normal laboratory conditions (18–25 °C). While it is stored, keep the TMM in a water/glycerol solution to prevent it from drying out and to avoid air contact. This solution contains 88.1 % (by weight) deionised water and 11.9 % (by weight) glycerol (purity > 99 %). While the TMM is stored, its surface should be submerged by at least 5 mm of solution.

The shelf life of the TMM, if it is preserved without air contact, is at least 1 year. To extend the shelf life to at least 2 years, add to the storage solution an anti-fungal agent: 0.5 % (by weight) benzalkonium chloride.

Disposal

For disposal, local regulations should be followed. Alternatively, the samples may be returned (by prior arrangement) to the Acoustics group at NPL.

Acoustic and thermal properties of materials (from Annex DD of IEC 60601-2-37 Ed 2)

Sample	Velocity C ($m\ s^{-1}$)	Density ρ ($kg\ m^{-3}$)	Attenuation coefficient α ($dB\ cm^{-1}\ MHz^{-1}$)	Acoustic Impedance Z ($kg\ m^{-2}\ s^{-1}$)	Spec. heat capacity C ($J\ kg^{-1}\ K^{-1}$)	Thermal conductivity κ ($W\ m^{-1}\ K^{-1}$)	Thermal diffusivity D ($m^2\ s^{-1}$)	Source of data
TMM	1540	1050	0.5	1.6×10^6	3800	0.58	0.15×10^{-6}	TNO
Silicone rubber	1021	1243	1.8	1.3×10^6	-	0.25	-	TNO/Dow Corning

Proportion of pure components in TMM

Component	% (by weight)
Glycerol	11.21
Water	82.95
Benzalkonium chloride	0.47
Silicon carbide (SiC (-400 mesh))	0.53
Aluminium oxide (Al_2O_3 (0.3μm))	0.88
Aluminium oxide (Al_2O_3 (3μm))	0.94
Agar	3.02
Sum	100