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Thermal conductivity of bonded materials for future generation gravitational wave observatories

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Future generations of gravitational wave detectors plan to use cryogenics in order to further reduce thermal noise associated with the mirror test masses and their suspensions. Characterising the thermal conductivity of the candidate materials for these mirror suspension systems (e.g. single-crystal silicon and sapphire), and quantifying the optimum heat flow through compatible bonding techniques for these materials, is therefore crucial. Preliminary results are presented here for hydroxide catalysis bonded silicon (100) samples of combined dimension 5x5x40mm. These results show a lower limit for the thermal conductivity of the bond at the level of 0.059 W/m/K. Studies will continue in order to better evaluate the thermal conductivity of hydroxide catalysis bonds, and investigate methods by which it may be optimised.

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