Robust Optical Fibre Sensors for Harsh Wastewater Environments

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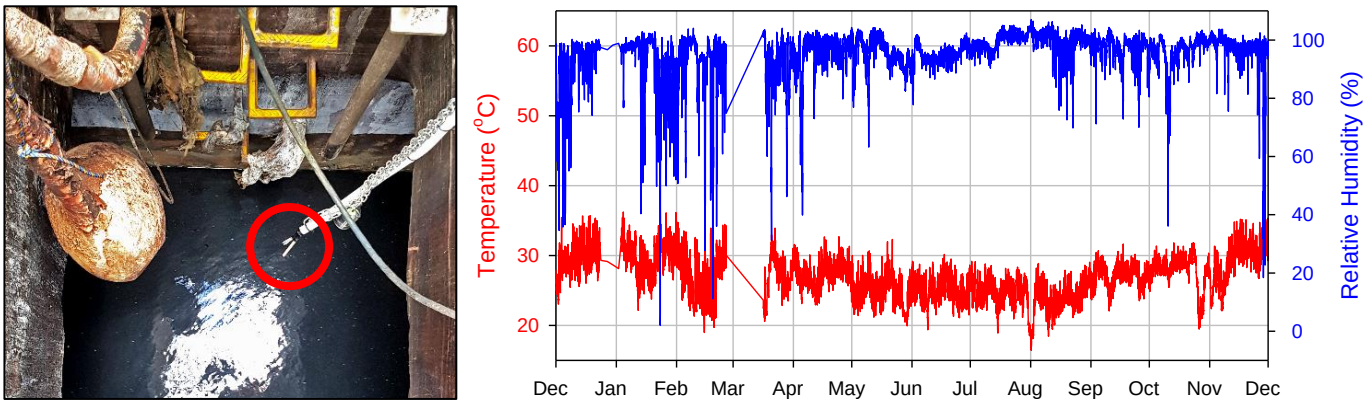
Together with the emerging Internet of Things (IoT), there is a drive to develop cost-effective remote monitoring technologies for harsh environments. Sustainable management of urban wastewater networks, for example, is a global problem where sewer pipes are plagued by numerous harsh conditions causing concrete attack. The result is premature pipe failure that comes with high financial, public health and environmental costs. Currently, water utilities do not have an in-situ, online monitoring capability for their concrete wastewater assets as conventional electrical sensors fail within days/weeks of installation due to the harsh, corrosive, biofouling environment. Here we report robust fibre Bragg grating (FBG) sensors that optically measure environmental conditions in wastewater networks over long periods.

Type II-IR FBG sensors were inscribed (without the use of a phase mask) in commercially available polyimide coated fibre using a point-by-point (PbP) technique and ultrashort laser pulses [1]. Temperature and humidity sensors with an accuracy of T ±0.3°C and RH ±1.5 % were field tested at a number of sites across Sydney Water's sewer network; being hung in the headspace above the flow either in gravity fed wastewater pipes or overflow tanks. The deployed sensors maintained accurate monitoring and surpassed a year's operation in all tested environments, far out-lasting their electronic counterparts. Further field deployment is ongoing.



(Left) Optical fibre sensors (circled) deployed in a Sydney Water sewer pipeline. (Right) Temperature and humidity data from the headspace of an anaerobic digester overflow tank.

[1] M. Ams *et al.*, 'Fibre optic temperature and humidity sensors for harsh wastewater environments', Eleventh International Conference on Sensing Technology (ICST), Sydney, Australia (2017)