Novel measurement and sensing technologies for thermal radiation of unwanted fires

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THERAD research aims at creating a new fire detection and measurement technology by combining gradient heat flux sensors (GHFS) with novel spectrally selective coatings into robust, low-weight and low-cost thermal radiation sensors. GHFS are based on the transverse Seebeck effect in anisotropic materials and generate thermopower proportional to the heat flux. First we will design the coating systems by computing the localized surface plasmon resonances on low-bandcap semiconductor particles. For spherical particles, we will use Mie theory for the absorption and scattering cross sections, followed by Monte Carlo simulations for the coating transmittance. The boundary conditions for the design calculations will be taken from narrow-band radiation solution (RADCAL) of combustion products. Next, we will investigate the suitability of sol-gel and pulsed electric current sintering (PECS) manufacturing techniques for making the micro- and nanoparticle inclusions in thin coating layers to implement infrared bandpass filters. Finally, coated sensors will be optimized and calibrated for the use in flame detection and measurement problems