

Cultural Heritage films preservation is nowadays understood as a two-phase action: on one side, it consists of restoring and recovering damaged film elements. On the other hand, an increasing attention is directed to monitoring the parameters responsible for the old films degradation. Usually, old films are composed of nitrocellulose (films produced up until mid-1940) or cellulose acetate (films produced starting mid-1930 and up to recent times). Traditionally the parameters monitored for preserving these films were temperature and humidity in the storage rooms. A new emerging problem in old film preservation regards phenomena of degradation caused by compounds produced by the films themselves, with type of gas produced and effect on the item depending on the composition of the artifacts themselves. Typically, nitrocellulose films will produce nitrogen oxides compounds (particularly NO₂), while cellulose acetate films will produce acetic acid. Both these class of compounds can catalyze further degradation in the film and, in case of spill-over, promote degradation in near, non-degraded films. In order to monitor such degradation processes, within the EU Horizon 2020 Program: NMBP-35-2017 - Innovative solutions for the conservation of 20th century cultural heritage (Nemosine), we have developed sensors arrays, based on nanomaterial-functionalized electrodes, able to selectively quantify the harmful gasses produced during films degradation (such as acetic acid or NO_x compounds) down to ppb levels. These nanostructured sensors have been used to assemble various sensor suites, each with a specific aim regarding conservation (i.e. direct film monitoring, Room-wide monitoring etc). The sensing solutions have further been optimized by developing a software which is user-friendly and allows the final user to easily evaluate if the concentration of any gas is over the threshold values. The proposed sensing solution has been designed for long life of its components and minimal energy usage, in order to minimize both component substitution and (if used without connection to a power source) battery replacement, thus minimizing the environmental impact of the platforms.