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DEGRADATION OF ORGANIC MATERIALS BY COLD OXYGEN PLASMA

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Cold gaseous plasma is an example of heavily non-equilibrium state of gas. It consists of gaseous molecules as well as different excited states such as free electrons, positively and negatively charged molecular ions, neutral atoms and excited molecules and atoms. It is created in a suitable electrical discharge by passing electrical current through gas. Since gas is in non-equilibrium state its temperature is not defined. It is common to use expressions like kinetic temperature (which is a measure of the average kinetic energy of gaseous species) and internal energy (which is a measure of the average energy of excited states). The kinetic temperature of free electrons is often close to 100.000K, while the kinetic temperature of neutral gas is often close to the room temperature. The kinetic temperature of ions is usually between these two brackets. The internal temperature of neutral molecules may be anywhere between 1000 and 30.000K, while that of ions often exceeds 100.000K. Plasma with such characteristics is an excellent medium for degradation of any organic material including bacteria and virus. The problem arises that plasma would also interact with the objects to be sterilized. This effect limits the current application of plasma sterilization to objects that do not interact with plasma radicals too much, i.e. those made from glass, ceramics and some metals. Plasma sterilization of objects made from polymers or composites is more difficult since the substrate itself readily interacts with currently available plasma. The main task of current research on plasma sterilization is on invention of plasma with characteristics suitable for degradation of bacteria, and inert to the objects. Recent advances in this field will be presented.