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Materials science approach to the structure of liquid water and some extraordinary interactions with EM radiation and charged particles in metallic sols

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The term "structure" of water has meant radically different things to chemists and materials scientists. By and large chemists have dealt with the separated "molecules," largely present only in the vapor state. Condensed matter science is concerned with the packing of whatever units exist in ionic, covalent or metallic bonded liquids or solids (including glasses and water). The first half of the talk provides the crystal chemical, thermodynamic, and phase diagram data establishing that many liquids exist—even stably, and assuredly metastably—in many different structures. This is certainly true of water; and the Kawamoto data have closed the discussion. The work of Samal and Geckeler and of Pollack, et al. also demonstrate the macro-heterogeneity of common aqueous solutions.

Obviously all intensive variables **must** change the structure of any phase continuously or with 1st order or higher order discontinuous transitions (such as order-disorder in alloys, or ferroic materials). While it is well understood that P and T qualify as such variables, most scientists are unaware that E (electric field) and H (magnetic field) are equally qualified variables. Theory for such is well developed. What has not even been considered is the experimentally observed radical difference in effects by AC and DC fields and of polarized and unpolarized radiation.

The data summarized from a dozen papers and presented will establish these unbelievable differences in the structure of **solid, crystalline** matter caused by E & H fields in 2.45 GHz microwave cavities (in samples separated by only 3 cm.) for the most important materials of all electronic technologies— Si, Ba-ferrite, $BaTiO_3$, TiO_2, etc. This makes the data presented on the changes in **liquid** water structure appear as minor effects, and much more acceptable. Changes in water structure caused by the presence of charged colloidal particles, and by radiation with the Na-D line (in growth of crystals of NaCl from aqueous solutions) are described. This is followed by a summary of changes in the structure of water (as established by spectroscopic techniques) caused by microwave photons, and then of RF photons (each successively with a thousand times lower energy than the other). In the RF case, the phenomenon of dissociation of very dilute aqueous solutions into H + O with only the application of a RF field opens a whole new chapter of the certainty of the major change of water structure with EM radiation, and the role of such in science and medicine.

The kinetics of the phase changes in water should clearly be the focus of applied research. We have also examined similar structural changes caused in very pure water by by the suspension as a sol of pure metallic silver 30 nm particles with a 5-7 nanometer substructure (with some oxide phases at subnanometer sizes) .The remarkable antibiotic properties of these aquasols is possibly due these charged particles and their influence on the structure of water.