solavite

FUNDAMENTALS OF SOLAVITE ACTION

Magnetism and electromagnetism

In physics, magnetism is the name associated to the phenomenon or set of phenomena related to attraction or repulsion observed in certain materials, particularly intense in magnets or ferromagnetic materials, as well as between such materials and drivers of electrical currents.

Although magnetism is an existing and determining force in natural and gravitational phenomena the technological application of magnetism and electromagnetism (their interaction with electrical currents) began to be better understood from the nineteenth century on.

In the nineteenth century, the Danish scientist Hans Christian Ørsted observed the influence of electrical current on magnetic fields while the English Michael Faraday concurrently with American Joseph Henry discovered electromagnetic induction, where there is electrical power generation in circuits placed under the influence of a constant or variable magnetic field.

In the twentieth century, the American Francis Sears demonstrated that any mobile charge creates or originates a magnetic field in its surrounding space, and that such field acts on any other existing mobile charge within its limits. That magnetic field around a mobile charge coexists with the electrostatic field which circulates in any charge. Any electrified particle within these two combined fields suffer the action of a force due to the electrostatic field, whether or not in motion. But the magnetic field only acts on the particle when that particle is in motion, generating a diamagnetic or paramagnetic behavior to the particle.

The term diamagnetism is used to describe the behavior of materials that are slightly repelled in the presence of strong magnetic fields. "Dia" in Greek means

"what scatters ". While paramagnetism is the alignment trend of electrons of atoms in an external magnetic field. "Para" in Greek means “what attracts".

A paramagnetic substance placed in a magnetic field is attracted to the region where the field is more intense, contrary to what occurs with a diamagnetic substance that is attracted to the region where the field is weaker.

Ørsted demonstrated that the movement of electric charges on wires can produce magnetic effects, while Faraday and Henry showed that displacement of magnets can produce currents. Faraday and Sears prove that every moving substance crossing a force field presents a diamagnetic or paramagnetic behavior.

Based on those principles it is possible to explain the SOLAVITE action in moving water. SOLAVITE applies the physics of atoms. The process by SOLAVITE enhances the physical principles of magnetic properties of matter and that of magnetic fields caused by moving charges.

Scaling and descaling

Scaling is a crystallization process, resulting from a magnetic polarity differentiation between the surfaces of pipes and existing minerals in water, or in another liquid, such as oil. Pipes and minerals have different polarity and/or different poles of minerals. Opposite poles attract each other forming scaling. Iron or even plastic pipes generate paramagnetic fields favoring scale-forming. If water or liquid passes through diamagnetic material, such as copper and former lead pipes, there is no attraction on the molecules of minerals.

Most of the substances require a surface to start the crystallization process. In the case of calcium carbonate ($CaCO3$), the crystal imperfections of metal serve as surface for the crystallization process. Calcium carbonate develops structures such as dendrites (similar to tree branches) on the surfaces of pipes, and the addition of successive layers due to the selective precipitation on surfaces result, with time, in a hard and glassy material.

Descaling is the process of mineral dissolution present in inner surfaces of pipes, machinery and boilers. To obtain a chemical dissolution it is necessary both to reduce the pH by acidification or by other treatments that consequently solubilize scaling, or to act as sequestrant of free ions interfering in precipitation processes.

Before the advent of SOLAVITE technology there were two basic techniques to control scale-forming in boilers and cooling towers. Both techniques require the addition of chemicals. The first one involves the use of chelating or dispersing agent plus a solvent that solubilized scaling. In the case of sulphate scaling, the most common chelating was the EDTA (ethylene diamine tetraacetic-acid). A drawback of such method is that it requires corrosion inhibitor products by the presence of chelator with corrosive action.

The second method requires the use of phosphates and dispersants, usually some kind of synthetic polymer to control the agglomeration of crystals, thus limiting scaling size. Through that method the formation of carbonates was replaced by phosphates that are not scale-forming.

SOLAVITE follows the process of decreasing the content of free ions, especially of scale-forming elements with no use of chemicals.

SOLAVITE is a Physical Catalyzer.

SOLAVITE is a catalysis process by electrostatic induct ion.

SOLAVITE is a strong diamagnetic catalyzer that enhances the Earth's ma gnetic field and harnesses the kinetic energy of the liquid to reverse the preponderance of paramagnetic behavior (attraction) of scaling-forming substances suspended in water to a diamagnetic behavior (repulsion).

When the moving liquid gets in contact with SOLAVITE catalyzer cells it undergoes an increase of the diamagnetic field and a decrease of the paramagnetic field.

SOLAVITE induces a diamagnetic field that generates an anisotropic effect over the scaling forming magnetic substances by changing the rotational motion of electrons, called spin. SOLAVITE alters the magnetic susceptibility of scale-forming elements, changing the way ions are grouped inside pipes.

SOLAVITE causes a complex and multifactorial phenomenon and the most important effect of SOLAVITE in water is the generation of nucleated crystals from the suspended salt molecules.

Mariategui Levy (1989) reported that SOLAVITE induces the formation of nucleated crystals of calcium carbonate in the form of snowflakes. Those microcrystals lead to crystallization of calcium carbonate in suspension in the solution, and not in walls of pipes and boilers.

SOLAVITE acts by promoting a rapid formation of nucleated crystals. The elements are firstly organized In very small crystals composed of a few hundred atoms. Initially, those grow as laminated crystals, and then take the form of snowflakes, different from crystallization in the form of dendrites that easily adhere to the surface of pipes, in case of $CaCO_3$. That structural rearrangement precipitates crystals of mineral salts as sediment thinly divided without adhering to the walls of pipes. That behavior was noticed by Knez & Pohar (2005) through experiments on the influence of the magnetic field in the Polymorph composition of calcium carbonate in aqueous solutions.

That SOLAVITE action makes the process an excellent preventive against the deposition of carbonates and silicates on the inner walls of pipes and boilers. Also, the rapid growth of nucleated crystals caused by SOLAVITE creates a permanent state where those same ions carry this effect by inducing similar behavior in surfacing molecules of preexisting scale thus dissolving them gradually.

Mariategui Levi, C.Y.J.F. Solavite Water Treatment Systems: Theoretical Explanation And Evaluation. New York.1989 KNEZ, S. POHAR, C. The magnetic field influence on the polymorph composition of CaCO3 precipitated from carbonized aqueous solutions . Journal of Colloid and Interface Science 281 (2005) 377-388