A New Paradigm in Material Classification

Have you ever asked yourself the question 'what is reinforced concrete', and thereby used the words like organic, inorganic or composite? If you are a regular reader of this journal, the question might seem strange. What is there to be strange, it's all about a combination of construction steel as reinforcements and cement (binder), or matrix. You may say concrete is a material. When was the last time you saw concrete as a material? You may think 'what was the author thinking when asking this sort of question? How long will the editor allow him to write such nonsense? For us, who know that there are metal and non-metal materials and their combinations?'

And what if the author now states that reinforced concrete is actually an inorganic non-polymer - polymer sandwich, an inorganic composite formation? In fact, a reinforced concrete panel or pillar. There is no concrete as a material. There are only concrete products. Where does this story come from? We have a need for definition of a new paradigm in material classification to inorganic and organic polymers and non-polymers.

Nobody has to concur with this classification at this time. But one day, it will exist nevertheless. In fact, it exists already. Can you imagine one single image showing all existing materials divided into four columns, with inorganic non-polymers, metals one of them? In this classification, the column with organic non-polymers is foreseen for lipids and oils. Everything else are either inorganic or organic polymers, zeolite, clay and all silicon-based materials being inorganic polymers, geopolymers. And the remaining, natural materials like fossil fuels, plants and animals, humans included, are organic polymers. With this, plastics and rubbers, or products from those material, are only ceiling-polymers. And sandwich materials can be composite and hybrid materials or composite and hybrid formations.

Has this all been verified? Is there such an image? Yes, there is, but since this opinion is in constant development, only the two latest publications will be listed [1,2]. And is there a complete description of this new classification published in a CC or WoS journal? There isn't. But the basic idea has been verified numerous times during presentations at international conferences and during lectures in inland and in foreign countries. Elements thereof have been published in journals with a respectable list of indices that monitor them.

What prompted the proposition for this invented change in material classification? The answer is the widespread use of inorganic and organic polymers. But also one of the four causes as defined by Aristotle. The key in forming the new paradigm was Alger's definition of polymers.

While writing this text, the author thought of the material sciences and technology professor R. Roy [3], originally from India. Why? The existing scholar interpretation of natural sciences has mathematics as its basis, followed by physics, chemistry and biology. R. Roy called such origins 'geocentric' and believed that a Copernican turn was necessary. Instead of having those disciplines at the core of education, he suggested to originate from current issues of today's world, such as nuclear waste, waste depots, pesticides (*but also, e.g. ski making*). His opinion was that middle education should concern first materials. Interpreting materials would motivate the students to learn about agriculture, mining, manufacture and craftsmanship as a whole. An understanding of these fields would require knowledge of biology, chemistry, physics and finally, mathematics. This concept was dubbed the *person centered model* by R. Roy. At the same time he represents the position that material science and technology is the central area of human activity, one every citizen should be acquainted with. In addition, by author of this editorial, they should know the fabrication processes, especially primary shaping.

Let's start from the beginning; Aristotle concluded that there is no level of matter (in the most general sense) without form [4]. This means that primary shaping always precedes the structuring at any specific level [5]. The primary shaping of inorganic non-polymer crystalline zirconium, that the chemical element zirconium is obtained from, happened some 4.3 billion years ago [6]. As primary shaping is always performed in a mould of some sort, this also happened in the inside of Earth's globe as a mould of a sort.

The formation of first organic polymers is also interesting, especially which substances are concerned. This stems from the aforementioned Alger's definition [7]. Alger's answer to the question 'what are polymers' is this: "*Polymers area collective name for natural and synthetic polymer substances (chemical compounds composed of macromolecules) and polymeric materials (technically useable substances) whose base ingredient is a system of macromolecules, macromolecular compound, with repeating units that can influence, with their spatial distribution, the occurrence of specific configurations or conformations,*" and adds: "The basic organic polymers are proteins, polysaccharides and nucleic acids [7]." It is from those basic organic polymers that occurred some 3.5 billion years ago [8] that the microorganisms, macroorganisms, plants and animals (humans included) developed. Dead plants and animals formed, among other things, fossil fuels. Pure natural products, natural resources like fossil fuels, humans can just acquire. The basic substances for creation of organic ceiling-polymers, plastics and vulcanised rubber, can be natural (i.e. natural rubber, oil or natural gas) and grown (corn, potato, plantated rubber). It is from these substances that materials can be produced, like polyolefins or products (pneumatic tire inner tubes).

Before the conclusion, just one more thought from the great thinker of natural and material sciences and technology, R. Roy, published in the "Materials World" magazine in commemoration of his death in 2010: "Teachers used to be concerned with students, lectures, writing books. Today they're concerned with contracts. Add to that writing reports (*and articles for single-language indexes*), and it raises the question of the university teaching staff still being able to perform their basic duties, the education and upbringing of new generations." To this we can add whether current teachers are ready to face new syntheses and paradigms? And not, in effect, just deliver by rote what they learned from their teachers.

The new classification of materials on polymers and non-polymers is one of such challenges. It is a challenge and a chance to finally start teaching process and production engineers about materials, not plastics, metals, rubbers, ceramics, wood or bones. Namely now each material is mostly educated on separate faculty.

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