## IV. Inventive Step

EPC requires an invention to involve an inventive step compared to the state of the prior art to be patentable.[125] The EPO usually uses the "problem-solution" approach to assess patentability over the inventive step requirement. The "problem-solution" approach consists, in the following order, of the identification of the closest prior art to the invention, the evaluation of the technical result obtained by the invention when compared to the prior art, the definition of the technical problem to be solved as indicated in the patent document, and the analysis of the likelihood of a person skilled in the art, taking into account the prior art, to suggest the invention to solve such technical problem.[126]

In the field of nanomaterials we can identify at least two situations of complexity in assessing inventive step requirements. The first one is related to the miniaturization of structures. Miniaturization is the reproduction of a known device, machine, material or any other physical structure in reduced size; in nanotechnology this size is in the order of nanometers. Similarly to the nanotechnology field, other technologies have experienced a process of miniaturization, for example, the electronics industry in the reduction of integrated circuits. Depending on the nature and characteristics of the invention, the new development can be patented or not.

Miniaturization of the structure of a known material may raise the question whether the invention is obvious when compared to the prior art. In fields outside of nanotechnology it is accepted that miniaturization generally does not allow an invention to pass non-obviousness requirement when compared to a prior known structure or device. For example, reducing the grain size of a metallic microstructure may not be considered as involving an inventive step, as it is known in the field that reducing the size increase resistance and toughness of the material and the prior art suggests following those steps in order to get better properties. At most, what may be seen as an inventive step is the process to reach such grain size, which may not be disclosed by the prior art. On the contrary, when metallic glasses appeared, a kind of

prior art reference placed the claimed subject matter in the public domain". In this way, also in the US the patent owners may face uncertainty regarding novelty of inventions that could be inherently anticipated by the prior art. For other commonly referred cases of inherence see In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977), Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) or Schering Corp. v. Geneva Pharm., 68 USP2d 1760 (CAFC 2003).

125 EPC, Article 56, Inventive Step.

126 European Patent Office, *Case Law of the Boards of Appeal of the European Patent Office*, EPO, 2006.

metallic microstructure characterized by the absence of an organized crystalline structure, they where considered non obvious and patented in view of the prior known metallic microstructures.[127]

Similarly to the aforementioned case, patentability can be assured by showing new properties not present in the prior art.[128] Following this condition, it can be said that patentability of nanotechnological inventions involving the reduction in size of structures is assured when the properties of the material are new, improved or unexpected for the person skilled in the art, provided that these properties are not suggested by the prior art.[129] In assessing inventive step and particularly suggestion in the prior art, case law of the TBA established that it is important to determine "whether a skilled person would have prepared [the invention] with a reasonable expectation that they would successfully solve the technical problem under consideration."[130]

Under this decision, the court said that the "problem-solution" approach requires the invention to be unexpected by the person skilled in the art to solve the technical problem as described in the patent. Therefore, in those inventions where miniaturization allows the material to have different properties, unexpected from the prior art, and those unique properties are used to solve an unknown or known technical problem, the invention is considered in accordance to the inventive step requirement. On the contrary, if the miniaturization to the nanoscale doesn't generate any distinctive property, which cannot be expected from the prior art, the invention will be considered obvious. Thus, two issues need to be considered: whether the prior art suggested the change of properties for miniaturized structures and whether the miniaturization was suggested as a trend to solve the technical problem under evaluation. This train of thought can be seen in a second important decision of the TBA.[131] In this case, the Board clarified that if "miniaturization was something like a trend in the field", and if "a skilled person was thus incited to "pack" known methods into smaller devices", the invention is not patentable under Article 56.[132]

Another example related to a radical change in properties when a structure is miniaturized to the nanometer level may be represented by singe-wall carbon nanotubes. These, when made in a specific configuration, perform like metals and

127 *See*, for example patent GB 1447267, *Amorphous Metal Alloy*, filed in 1973.

128 Nicola Dagg, *The Eurpean Perspective and Regulatory Concerns of the Nanotechnology Movements*, available at http://www.aipla.org/Content/ContentGroups/Speaker_Papers/Spring_Meeting/20045/dagg_nicola.pdf, (last visited May, 2009).

129 *Id.*

130 T 0116/90.

131 T 0070/99.

132 *Id.*

not as semiconductors in terms of electrical conductivity. This property is unexpected for carbon, a material that was not used in the past as an electricity conductor material. Consequently, this characteristic of carbon nanotubes allow them to have an electrical conductivity much higher than normal copper or gold, shifting the material from semiconductor to metallic conduction properties, allowing them to be perfect replacements of electrical connectors in microchips and integrated circuits.[133] Notwithstanding that the exact set of claims is needed to make a more precise assessment of the patentability of the invention, we can predict that patentability would be assured for the use of nanotubes as electrical connectors provided that the prior art doesn't make available the teaching on the use of carbon as electrical conduits, and that the conductivity of the nanotubes is far different from that observed in normal carbon.[134] Other inventions where reduction in size generates different and unexpected properties are composite materials filed with nanoparticles in order to control permeability properties. In absence of prior art indicating a trend in manipulating particles to control permeability at a nanoscale, the skilled person in the art cannot extrapolate the teaching provided by the prior art to the new nanoscale conditions.

Some questions still remain unsolved. How different need the property be with respect of the prior art to make the invention non-obvious? Need it be qualitatively or only quantitatively different from the one observed in the known material? May a difference in 20% of the evaluated property be enough to consider the invention inventive and non-obvious? Until now, the tool used to answer these questions is the "problem-solution" approach, for which we need to define the technical problem that the new developed material is able to solve and to evaluate if such material and property, as a solution for the problem, was already suggested by the prior art. In using this approach, one of the key factors is how the courts will define the person skilled in the art, and the level of inventiveness that will be given to her. Depending on this construction the answers to the questions above will be different. There is no uniform criterion developed yet for all technologies to define this person in all technology fields, as is already quite uniformly defined in other complex areas like biotechnology. This brings uncertainty to validity of nanotechnology related patents, which cannot be fully overcome at the moment. Only a careful strategy followed by applicants can reduce the risk of invalidation by the reach of a good balance among

133 *See,* for example patent US 7,338,915, "Ropes of single-wall carbon nanotubes and compositions thereof", granted in 2008.

134 For an example of modified carbon nanotubes used as conductors in electronic circuits, see patent application EP1575102A1, "Electrical conductor based on proton conducting carbon nanotubes", filed in 2004.

disclosure and full coverage of all allowed type of claims directed to protect all the different aspects of the invention.[135]

In addition to this strategy, to be on the safe side, applicants may decide to claim the invention in a more limited way, including not only product claims in the patent application but also further embodiments, for example, the specific uses and the manufacturing process of the material subject of the invention. Nevertheless, because of the high potential value of patents in nanotechnology, other applicants will decide to take the risk and claim their inventions in the broadest and most general way that is possible. Pure product claims or functional claims may be chosen instead of the more limited version of process claims.

135 In assessing obviousness of miniaturized structures, a similar approach is followed in the US. The United States Patent and Trademark Office (USPTO) has identified several cases that may play a role in the assessment of patentability in nanotechnological inventions, (*see*, Bruce Kiusliuk, Nanotechnology-related issues at the USPTO, USPTO, 2006). Also here, there is no doubt that mere miniaturization of something known is not patentable, provided that such miniaturization doesn't provide any new or unexpected result not proposed by the prior art. For example, case law recognized that "it is well established that the mere change of the relative size of the co-acting members of a known combination will not endow an otherwise unpatentable combination with patentability" (47 C.C.P.A. 795, 274 F.2d 944, 124 U.S.P.Q. 502 (1960)). In line with this decision, other relevant case established that, "dimensional limitations did not specify a device which performed and operated any differently from the prior art" (725 F.2d 1338, 220 U.S.P.Q. 777 (1984)). Even when these cases are not related to nanotechnology, the concepts developed in chemistry, mechanical devices and electronic can be extrapolated to a more recently technology. Because the generation of new or improved properties in materials and the control and manipulation of those properties to adapt them to specific uses characterize nanotechnology, the inventions may not be considered obvious under Section 103, because a difference in size is not the only distinction with the prior art.