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O. Eng.

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CLASSIFICATION OF A PRODUCT CALLED "YTTRIA C"

(Item IX.10 on Agenda)

I. BACKGROUND

1. On 9 April 2003, the Secretariat received a note from the EC asking it to place the classification of a product called "Yttria C" on the agenda of the 31st Session of the Harmonized System Committee. The Secretariat was also asked that the information on the composition and the usage of the product in question be treated with strict confidentiality and made available to the delegates of the HS Committee for classification purposes only. Accordingly, copies of the certificates of analysis for the product "Yttria C" and for yttrium oxide, attached to the note, will be made available to the delegates during the meeting.

II. NOTE FROM THE EC

2. "The chemical product in question is yttrium oxide (Y_2O_3), to which a (very) small amount of vanadium pentoxide has been added as a sintering aid. The Austrian Customs laboratory made an analysis with an energy dispersive X-ray fluorescence spectrometer and detected 99.6% yttrium oxide and 0.3% vanadium oxide (V_2O_5).

3. The vanadium pentoxide was deliberately added to alter the yttrium oxide's physical properties. It significantly alters the surface area and the particle size. According to the manufacturer, "Yttria C" differs visibly and significantly from unaltered yttrium oxide in its surface area ("Yttria C" : 0,537 m²/g, yttrium oxide : 5,12 m²/g) and particle size ("Yttria C" : 16,37 µm, yttrium oxide : 5,87 µm). The added vanadium pentoxide also lowers the melting point.

4. The alteration in the physical properties means that the vanadium pentoxide cannot be considered as a stabiliser. Stabilisers are additives necessary to maintain a chemical product (pure yttrium oxide in this instance) in its original physical condition, so they must not alter its properties. Since adding vanadium pentoxide does alter pure yttrium oxide's properties, the product cannot be classified in Chapter 28.

Note : Shaded parts will be removed when documents are placed on the WCO documentation database available to the public.

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5. Nor can vanadium oxide be seen as an impurity : vanadium is not a rare earth metal and therefore does not occur naturally with yttrium. This excludes the product from the oxides of rare-earth metals referred to in the Explanatory Note to heading 28.46.

6. The specific surface/particle structure obtained by adding a small quantity of vanadium pentoxide (pressing, sintering) confers on the physically altered yttrium oxide, after milling and sieving to the required technical form, the requisite technical properties for use as a facecoat material for investment casting, e.g., for the manufacture of aircraft parts.

7. The addition of the vanadium pentoxide is absolutely required to create a very dense product with a very low specific surface area. "Yttria C" is used in the investment casting industry as a so called facecoat material to cast near net shape parts like frames for airplanes, etc. The part to be produced is formed as a wax-pattern. This wax-pattern is dipped into a slurry made of "Yttria C" and different other components like binders. The wax-pattern coated with this "Yttria C" slurry is then dusted with aluminium oxide flour and then dipped again in the slurry. By repeating this process different times a so-called thick shell is produced around the wax-pattern. Then the wax is melted and poured out of the shell. The shell is fired and this results in a very stable ceramic mould. Then a molten metal is cast into this ceramic mould and after solidification and cooling the ceramic shell is destroyed and the metallic part (e.g., airplane frame) remains in the required net shape.

8. "Yttria C" is used for the casting of reactive metals like titanium, which tend to react with ceramic mould materials like aluminium oxide or zirconium oxide. The first contact layer between the molten metal and the ceramic mould has to be a very dense and non-reactive material. A pure yttrium oxide raw material is not suitable for this process as the low density and different particle size distribution would enable the molten metal to diffuse through the facecoat layer and react with the aluminium oxide to create defaults and inclusion not acceptable especially in the airplane industry.

9. According to the Explanatory Note to heading 28.46 (last sentence of page 361), "mixtures of compounds which could be conceived as having been made intentionally for special purposes ... fall in heading 38.24." Therefore, this product has to be classified in subheading 3824.90."

III. SECRETARIAT COMMENTS

10. Despite the fact that only a very brief description of the treatment of a pure yttrium oxide raw material to obtain the product at issue was given, on the basis of information available the Secretariat has prepared the following description for classification purposes. To facilitate the discussion of the Committee, the EC may, however, wish to further clarify the manufacturing process and provide additional information on the form in which the product at issue is presented.

Yttrium oxide treated by pressing, sintering, milling and sieving to the required form. During this treatment, a very small amount of vanadium pentoxide has been added as a sintering aid. Physical properties of the treated product (surface area, particle size and melting point) differ from that of untreated yttrium oxide, thus enabling its use in a particular industry.

11. As regards classification, the Secretariat agrees with the EC that headings 28.46 and 38.24 merit consideration and that the possibility of classifying the product in heading 28.46 should be examined first.

12. In accordance with Note 1 to Chapter 28, except where the context otherwise requires, the headings of Chapter 28 cover separate chemical elements and separate chemically defined compounds. Heading 28.46 refers to compounds of rare-earth metals, of yttrium or of scandium or of mixtures of these metals. As pointed out by the EC, vanadium does not belong to the group of rare-earth metals and therefore a mixture of yttrium and vanadium oxides would not be specifically described by the wording of heading 28.46. Thus, the context would not "otherwise require" with regard to the product at issue and the addition of vanadium pentoxide should be examined in terms of the provisions laid down in Notes 1 (a) to (e) to Chapter 28.

13. As stated above, vanadium pentoxide was not added for the preservation or transport of yttrium oxide and therefore the Secretariat shares the conclusion of the EC that it cannot be considered to be a stabiliser permitted by Note 1 (d) to Chapter 28. However, in connection with Note 1 (a) to Chapter 28, the question remains whether vanadium pentoxide should be considered to be an impurity resulting from the manufacturing process or whether the product at issue could be regarded as a mixture of the two components intentionally mixed for a specific use.

14. The General Explanatory Note to Chapter 28 (Part (A), second paragraph on page 261) states that impurities may result from any of the factors involved in the manufacturing process and gives a list of examples. Since this list is introduced by the word "principally", the Secretariat would not consider it to be exhaustive but indicative only. The same General Explanatory Note further stipulates that when such substances (mentioned in the indicative list) are deliberately left in the product with a view to rendering the product particularly suitable for specific use rather than for general use, they are not to be regarded as permissible impurities.

15. In paragraph 3 above, the EC expressed the view that vanadium pentoxide was deliberately added to alter the yttrium oxide's physical properties, such as surface area and particle size. On the other hand, according to the information available, it appears that the yttrium oxide at issue has been treated by pressing, sintering, milling and sieving. Thus, the milling and sieving operations themselves indicate that the particle size and the surface area of the yttrium oxide raw material and the yttrium oxide final product would be different, with or without addition of vanadium pentoxide.

16. Furthermore, sintering in general has an influence on particle size and particle surface area. According to Ullmann's Encyclopedia of Industrial Chemistry (Sixth Edition, 2001, Electronic Release), particles of the material are rearranged and/or change their shape during sintering, which causes the porosity of the material to be reduced and the fraction of solid material to be increased in each unit volume cell. These effects can be manipulated by using sintering additives.

17. Ullman's Encyclopedia further states that additives, unlike impurities, are intentionally added to the sintering systems. The usual impurity level is below 1000 ppm, whereas the amount of additive may vary from 0.1 to 10 wt %. Additives are frequently used to accelerate shrinkage (porosity decrease) (e.g., Ni for W or MgO for Al_2O_3) and they enhance one of the diffusion mechanisms leading to shrinkage (e.g., grain boundary diffusivity) or suppress

mechanisms which lower the driving force (e.g., surface diffusion). Densification, dimensional control, and homogenisation can also be influenced by additives which are present as a second solid phase. These additives may provide a fast diffusion path for the host atoms. The additive may also form inclusions or obstacles which retard densification and grain growth.

18. That being said, it appears that additives/sintering aids accelerate, enhance and support the physical changes of the material during sintering but are not an initiator of such changes. Furthermore, the EC has indicated that a pure yttrium oxide raw material is not suitable for the same use as "Yttria C". However, in order to precisely determine the role of the addition of vanadium pentoxide, it would be useful to know what would be the physical characteristics of the yttrium oxide treated in the same way as "Yttria C" (including sintering) but without addition of vanadium pentoxide.

19. In the light of the above, the EC may wish to provide more information regarding the function of vanadium pentoxide in the manufacturing process of "Yttria C" and information as to whether the vanadium pentoxide in "Yttria C" performs any specific function in its use in the preparation of ceramic moulds.

20. In conclusion, the Secretariat considers that the questions whether vanadium pentoxide is an impurity resulting from the manufacturing process and whether its addition does or does not render the product suitable for a specific rather than for general use must first be considered. Depending on the answers to those questions, classification in heading 28.46 may be appropriate. If, however, the vanadium pentoxide is not such an impurity and the Committee considers "Yttria C" to be an intentional mixture of chemical compounds specifically prepared with a particular use in mind, classification would be directed to heading 38.24.

21. In any case, and in view of technical nature of the matter, the Committee may wish to obtain the views of the Scientific Sub-Committee on these questions before it takes a final decision on the classification of the product.

IV. CONCLUSION

22. The Committee is invited to rule on classification of "Yttria C", taking into account the comments from the EC and the Secretariat's comments above.