Wendel Email

Comments on the draft of Enamels/Ceramics Assessment Basis

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Basis for assessment of enamels and ceramic materials in contact with drinking water (Enamels/Ceramics Assessment Basis)
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Please receive my comments regarding the draft of the guideline named above.

1. **TiO_2:** The oxide positive list (table 1) limits titanium dioxide to a maximum of 10%. By that, you exclude all white enamels. However, there is no reason to exclude white enamels for the use with drinking water. Especially as we may not expect that TiO_2 migrating out of the enamel surface might ever reach the level of toxicologically relevant concentrations. I propose to exceed the upper limit to a level of 16% TiO_2.

2. **Thermal stability:** the text hereinafter describes „The enamel layer cannot be infiltrated, is non-diffusible and thermally stable up to 300 °C.“ The thermal stability of vitreous enamels is much higher. Generally, vitreous enamels can be used up to a temperature of about 30°C below their transformation temperature. The „softest“ vitreous enamels, that would comply to the demands of this assessment would have a transformation temperature of about 420°C. Therefore, the thermal stability should be exceeded to 390°C.

3. **Standard for test sample:** In section 8.3.2 sample the requirements are described and the footnote refers to the wrong standard: „ Samples must reflect the requirements for samples pursuant to DIN 4753-3: 2011 “. Anyway, European documents should not refer to national standards. The standard for the production of enamelled specimens for testing purposes is EN ISO 28764 „Vitreous and porcelain enamels – Production of specimens for testing

enamels on sheet steel, sheet aluminum and cast iron (ISO 28764:2008)". DIN 4753-3 stringently requires steel samples: „the plane samples (105 mm × 105 mm or with a diameter of 105 mm) must use the same steel thickness and the same steel material which is used for the main components for the vessel (e.g. jacket)." Additionally this water heater standard names DIN EN ISO 28706-2 for the production of the samples. When studying DIN EN ISO 28706-2 one will find out that this standard refers to DIN EN ISO 28764 for the production of the samples. The claim for steel samples within the water heater standard dissents to the claim of the assessment basis, to use the same base material for the samples, which is used for the produced articles.

4. **Cast iron samples** of 16 mm gauge, according to the base material, may only be fixed very unstable into the migration apparatus (figure 1). In this case we have to use steel samples. These 2mm steel samples may only be fired within the production, when using small articles. In production, the demand of the assessment basis can only be achieved using very special conditions. Frit producers are used to simulate test conditions of production lines and therefore may produce enamelled steel samples that perfectly comply chemically and physically with the cast iron production. The assessment basis does mention in section 8.1. this possibility and section 8.3.2 then refers to chapter 9, where this sampling should be pointed out as well: e.g. a note (enamelled test specimens for cast iron may be also produced by the frit supplier).

5. **The component-specific conversion factors** in section 8.3.5 „analysis of the test results" listed in table 11 do not represent large enamelled drinking water tanks. There are enamelled bolted steel tanks for drinking water storage in use able to store volumes of approximately 10,000 m³. The conversion factors listed do not meet these requirements. Even when the vitreous enamel would be dissolved completely (that doesn't happen) the concentration of enamel in drinking water would not exceed 36 ppb – the test does not meet this use at all.

6. **Test water:** The migration test is carried out pursuant to DIN EN 12873-1. The test water used shall be fully demineralised water with a conductivity less than 1 µS/cm. EN 12873-1 requires a water with a conductivity less than 2 mS/m (which corresponds to 20 µS/cm). EN 15644 characterises three types of drinking water existing in Europe. The test water should be a surrogate for drinking water. Ultrapure water (conductivity < 1 µS/cm) leads to an osmotic attack of the surface. Using this test condition (especially for long migration periods an high temperatures) every surface will be dissolved uniformly and all components will appear in the test water. This mechanism is not related to the corrosion attack of a drinking water. Drinking water attacks at higher

temperatures vitreous enamel surfaces through a combined acid-alkaline mechanism. Using ultrapure water as test water will cause materials to fail the test even if they could be used safely for years under real conditions at high temperatures. Especially when using 85°C the wrong surrogate "ultrapure water" will lead to wrong results.

7. **Analysis of migration water:** It is not necessary to use an ICP-MS spectrometer for water with a conductivity less than 1 µS/cm. A standard ICP spectrometer is fully compliant and by far more common. As the detection limits are compliant and as there is always a blank test (middle chamber) this request is incomprehensible. It should be the target of guidelines to facilitate test for the industry and not to make them inaccessible.

Best regards,

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