



Standard Classification for Advanced Ceramics¹

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1. Scope

1.1 This classification covers a system by which advanced ceramics may be classified. The system has been devised to cover all types of advanced ceramics in the forms of inorganic precursors for ceramic powder production, powders, granular forms, fibers, whiskers, platelets, single crystals, consolidated polycrystalline ceramics, amorphous (glassy) and composite materials, and components in block and coating forms. The structure of the classification system is coded to be machine readable.

1.2 The classification system has been developed through an international collaboration under the auspice of the Versailles Advanced Materials and Standards Project (VAMAS) Technical Working Area 14, and with support from the Commission to the European Communities, ASTM Institute of Standards Research, and the Japan Fine Ceramics Association. Its construction was based on the results of an international survey of requirements among manufacturing and user industries, and recommendations provided at an international workshop held at Ispra, Italy, in June 1990.

1.3 The present range of products that is encompassed by the term *advanced ceramics* or one of its synonyms is enormous in breadth, and complex in chemistry, form, processing route, and property attributes. Normally, there are close interlinks between these factors. It has therefore been impossible to devise a simple hierarchical scheme, such as that used in IEC 672 for electrotechnical ceramics for insulators. The system developed and incorporated in this classification is novel in many respects to encompass all foreseen requirements and purposes, and all raw and manufactured materials and applications. It has great flexibility and is amenable to computer recognition and programming.

1.4 *System Constraints*—It is not the purpose of this classification to specify how the system shall be used. The user is able to define the coding combination and the level of detail to suit a particular purpose. This classification provides only a flexible framework within which this might be done.

1.4.1 The classification system includes only those ceramic products defined and designated by ceramic manufacturers, trade associations, and professional societies as advanced

ceramics (see 3.1.1). On this basis, the classification system does not cover:

1.4.1.1 Elemental carbon, except for specific ceramic forms such as diamond, vitreous carbon, and chemical vapor deposit (CVD) graphite;

1.4.1.2 Elemental silicon, elemental germanium, and other elemental or compound semimetallic (intermetallic) substances other than when they form an integral component of, or precursor for, an advanced ceramic;

1.4.1.3 Traditional ceramics based on clay, including: porcelains; whitewares; sanitary wares; floor and wall tiles;

1.4.1.4 Unshaped and shaped refractories and bulk glasses for tonnage applications; and

1.4.1.5 Flat or container glass.

1.4.2 This classification provides a classification system framework that allows comparison and correlation of collected data/information with that gathered under other classification systems, such as the Standard Industrial Classification (SIC) code and the international convention on the Harmonized Commodity Description and Coding System. The SIC is the statistical classification standard underlying all establishment-based U.S. Federal economic statistics classified by industry. The SIC code covers the entire field of economic activities and defines industries in accordance with the composition and structure of the economy. The Harmonized System, an international system designed to standardize commodity classification for all major trading nations, in a relational way is similar to the SIC system.

1.4.3 Currently, advanced ceramics are not represented as a specific code field in either the SIC or the Harmonized System, but are included in other categories where other material classes dominate and in which the advanced ceramics comprise only a small fraction of the end products of the classification.

1.4.4 This standard recognizes the relationship between classification systems, but does not present a detailed cross-walk between individual system fields. This relationship is illustrated by the following examples:

1.4.4.1 In structural applications, advanced ceramic products are found in motor vehicle parts and accessories (SIC 3714), steam, gas, and hydraulic turbines (SIC 3511), motors and generators (SIC 3621), aircraft engines and parts (SIC 3724);

1.4.4.2 In mechanical applications, advanced ceramic products appear in cutting tools (SIC 3545), ball and roller bearings (SIC 3562), pumps and pumping equipment (SIC 3561), and

¹ This classification is under the jurisdiction of ASTM Committee C-28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.91 on Nomenclature.

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