REPORT ON LEAD IN CERAMICS*

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The Ceramics Technical Committee met informally for the first time in July, 1955 to consider whether any activities on the part of the Association might improve the market for lead in all branches of the ceramic industries and, if so, what steps might be recommended to the Association's Industry Development and Executive Committees. At this meeting it was unanimously felt that there is a sizable market for lead products in the ceramic industries which might be further developed.

As a first step it was decided to recommend that all available information on the use of lead in ceramics be gathered into a manual for circulation to people connected with the ceramic industries, and that this manual be followed by supplements as new information became available. Until these steps were taken it was not felt that advertising or research should be considered since in the process of gathering the information for the manual loop-holes and weak spots in our knowledge would be developed.

These recommendations were presented to the Association's Industry Development and Executive Committees, together with a recommendation for an appropriation of $18,000 to carry the work to the end of 1956. Approval was granted and the Committee met formally in September. It is composed of:

	Representing
John W. Ayers, Jr.	Evans Lead Division, National Lead Co.
William J. Baldwin	Titanium Alloy Manufacturing Division, National Lead Co.
Thomas B. Blair	Western Lead Products Co.
Dudley H. Haskell	W. P. Fuller & Co.
Arthur Knight	Easton Lead Co. (Gliddon Co.)
Willard Midgette	Eagle-Picher Co.
John S. Nordyke	Hammond Lead Products Co.

I was retained as consultant to the Association on ceramic matters and elected chairman of the Committee.

The Committee members divided the task of covering all phases of the use of lead in ceramics and individually submitted their reports to the Association's Secretary for the compilation of the first draft. A second meeting was held during February during which areas needing more attention were discussed. The manual is now nearing completion and should be published in the early summer.

* Presented at the 28th Annual Meeting, Lead Industries Association, April 24-25, 1956, St. Louis, Mo.

A list of about 4,000 ceramic people has been compiled from national and state ceramic association rosters to receive this brochure and subsequent additional material.

The many uses of lead in ceramics are to be referred to in the manual. Some of these are old established users, some recently developed and others in the research stage but look promising. All depend on one or more of the unique properties which lead imparts to ceramics, and no other material will serve the purpose.

Examples of Established Uses

We might briefly refer to several of these unique properties in connection with some of the old established uses of lead in ceramics:

(a) As a component of glaze compositions, the use of lead compounds provides many advantages, e.g., greater fluidity and wider softening range, improved texture and smoothness of surface, greater brilliance and generally a more fool-proof glaze. These advantages along with others (e.g. thermal expansion and elastic moduli considerations) make lead a highly valued ingredient of a number of white ware glazes for dinnerware and tableware, various types of ceramic tile, and for china plumbing fixtures.

(b) High index of refraction, along with other favorable properties accounts for the use of lead glasses for optical purposes and for the finest quality stemware and art glass.

(c) Lead glass is used widely for electrical and electronic applications because of the excellent electrical properties and working characteristics imparted by lead. Examples of uses here include stem and exhaust tubing, neon-sign tubing, and television picture tubes. Lead glasses have other important uses, e.g., reflective glass beads.

(d) Lead is commonly used in the dry process enameling of cast iron both in the ground coat and cover coat enamels. The main advantages impart by lead for this application result from greater smoothness and brilliance derived from its high fluxing property coupled with increased resistance to chipping and improved elasticity. Specific examples of this use include bath tubs and other vitreous enameled cast iron sanitaryware.

Examples of Relatively New Uses of Lead in Ceramic Products

Here are some examples of relatively new uses of lead in ceramic products:

(a) Lead is an important raw material in the only satisfactory enamel for aluminum providing a dense, hard surface and providing a maturing temperature in a wide firing range well below the temperature which would be detrimental to the aluminum base. High hopes are held for the future of this material.

(b) Lead glazes for ceramic dielectric bodies have been proven to be superior to all other type coatings in maintaining high resistivity under extreme conditions of humidity and temperature. The principle use here is in coating the many ceramic dielectric parts used as such or in components for high frequency electronic equipment such as radar.

(c) High lead glasses as a result of their high density and opacity to radioactive energy are finding use as a shielding material in radiation protective windows.

Recent Developments

Recent developments include many suggested unique uses of lead in ceramic products.

(a) Lead oxide-based piezoelectric ceramics for sensing elements in accelerometers, sound detectors, ultrasonic devices and transducers. Even with a complete replacement of the presently used material, the tonnage used here would be small. This is in contrast to the next item which would involve considerably more material. However, there are numeral small tonnage uses which would augment the larger uses.

(b) Ultra low loss high frequency insulation for electronics. Two types of bodies containing 40 to 70% lead bisilicate have been developed which have zero shrinkage. These provide for easier fabrication of parts where extremely close tolerances are prerequisite. The trend towards higher frequency electronic equipment has required the concurrent development of ultra low loss ceramic. The best ceramics made to date require the presence of lead in their formulation.

Sponsored research may help stimulate the extended use of lead. One example might be noted - the enameling of metals other than aluminum; e.g., - enameling of sheet steel with lead bearing enamels which are not now used for this purpose to any large extent and offer an extensive market. This is receiving considerable attention but on a confidential company basis and it is difficult to secure specific information on this since there are no publications. Sponsorship of research in selected areas such as this would result in publications which would accelerate the use of lead in specific applications by making the results generally available.

The Technical Committee may recommend to the Association's Industry Development and Executive Committees at the proper time specific programs in selected areas where they believe most good will be accomplished in extending the use of lead in ceramics.

The Technical Committee is optimistic in its outlook of the good which can be accomplished by the Association's efforts not simply from the standpoint of increased sales of lead to this industry but also in the continued development of special ceramic products which are superior as a result of the use of lead chemicals.

Several proposals of research studies have already been received but your Technical Committee felt that it was too soon to consider undertaking such studies, i.e., prior to careful consideration on the Committee's part as to which avenues would be most profitable.

Getting back to the brochure, it is the Committee's intention to make this manual into a valued source of information including data, formulas, bibliography, a chapter on handling of lead, and also a chapter on availability of lead chemicals and dependability of future lead supplies. The wide variety of properties to be discussed will serve to emphasize the great versatility of lead compounds in numerous ceramic formulations and will help to explain why lead can do so many things so well.