LEAD INDUSTRIES ASSOCIATION

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METALLIC LEAD PRODUCTS DIVISION

re Lead Chemical Construction Bulletin No. 11

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CHEMICAL BULLETIN NO. 58

SUBJECT: LEAD AS A MATERIAL FOR CHEMICAL CONSTRUCTION

To Members of the Metallic Lead Products Division:

Attached is a reprint from the November, 1954 issue of "Chemical Engineering," which is devoted to materials of construction, and has a section on each of the materials used for construction in the chemical industry.

The article on lead was prepared by the magazine's staff in cooperation with the Lead Industries Association but the headline, which is significant, is solely that of the magazine's staff.

This reprint is also being mailed, as one of our series of Chemical Construction Bulletins, to our mailing list of approximately 1300 chemical construction companies, chemical engineers, chemical engineering professors, and others interested in chemical construction.

Additional copies are available, free of charge, as long as our supply lasts.

Very truly yours,

Robert L. Ziegfeld

Robert L. Ziegfeld
Secretary

COMPOSITION

Chemical lead	99.90 min. lead + small percentages of silver and copper, others.
Acid lead	99.60 min. lead + small percentages of silver and copper, others.
Copper lead	99.60 min. lead + small percentages of silver and copper, others.
Antimonial (hard)	Lead + 1-12% antimony, others.
Tellurium lead	Chemical lead + about 0.06% tellurium.
Other alloys	Tellurium antimonial lead, calcium lead, others containing silver or other elements in fractional percentages.

PRODUCTS

Lead pipe		
Bends, fittings, flanges		
	Lead-lined steel pipe	
Lead pump	Lead coils	Cooling coils
Lead-lined acid brick pipe	Process instruments	Lead sheathing

Lead-protected components of absorbers, condensers, decomposition towers, filters (wet and dry), fume ducts, fume scrubbers, gas washers, packings, pickling tanks, precipitators, pumps, separators, storage vessels, valves, vessels.

APPLICATIONS

Acid recovery (regeneration process), acid recovery (recovery processes), air pollution control, chromium electroplating, bleaching, Claus process, chemical processing, copper leaching, dye intermediates manufacture, electrolytic refining of copper, Fe-Cu-Zn, fertilizers, fumigation, hydrometallurgical processes, refrigeration, stream pollution control, sulfidizing, sulfonation, sulfuric acid production, waste recovery.

MORE THAN HOLDING ITS OWN:

Lead

Despite the development of competing materials, its applications continue to grow—due to its inherent characteristics and experience from long and varied use.

Lead and its alloys are widely used in the construction of equipment for the production, transmission, storage, and use of a variety of corrosive chemicals. Experience has taught where and how lead may be used to best advantage, and has resulted in improvements in construction and installation methods.

Chemical lead, acid lead and copper lead are the grades usually specified for chemical construction. The small amounts of silver and copper in these leads add to the corrosion resistance and improve its creep and fatigue resistance.

Antimony hardens lead and improves its physical characteristics up to the boiling point of water. However, it lowers the melting point and while it may not detract from lead's corrosion resistance, seldom does it improve it.

Tellurium in extruded lead products retards grain growth and increases fatigue resistance. Corrosion resistance is comparable to chemical lead.

In lead clad products, lead's corrosion resistance is combined with the strength of steel or the high heat transfer of copper.

Vessels designed for operation at high temperatures, fluctuating temperatures or vacuum are usually constructed of steel with a lining of lead bonded directly to the steel. Heating coils of copper with an external lead cladding are in common use, as are steel pipes and valves with an internal lead cladding.

Among the many variables determining the suitability of lead or any other material may be temperature, concentration, grade of lead or type of alloy, presence of oxygen, degree of abrasion-erosion and presence of impurities.

Lead relies for its high resistance to corrosion upon a thin protective coating that forms on its surface.

Where this coating is one of the highly insoluble lead salts such as the sulfate, carbonate or phosphate, resistance to corrosion is high and the environmental factors necessary to maintain the protective film are established.

On the other hand, if a soluble film forms such as the nitrate, acetate or chloride, little protection is afforded, and the lead may corrode further. Likewise, if insoluble protective coatings are removed mechanically (as by abrasion or erosion) or dissolved chemically (as in the case of some mixed corrosives), corrosion resistance is similarly reduced.

Dilute nitric acid is an example of a corrosive which reacts with lead to form a soluble salt. It is also capable of reacting with lead sulfate to reduce its function as a protective coating depending upon the concentration. Obviously where lead linings are protected by a brick lining, the protective coating or film will not be disturbed.

In the case of corrosives which, in themselves, do not readily form a protective film and will not dissolve lead sulfate, it is often possible to make the lining corrosion proof by scrubbing the lead with dilute sulfuric acid or filling the vessel with dilute sulfuric acid for a short period of time to establish a protective sulfate film on the surface.

Lead generally has good resistance to neutral solutions where lead carbonate and possibly oxide are corrosion products, and fair resistance to alkaline solutions in which these are soluble. Experience has shown that lead is commercially resistant to chromic, sulfuric, sulfurous and phosphoric acids, that it is subject to corrosion at somewhat higher rates by hydrochloric and hydrofluoric acids and that it is susceptible to being strongly corroded by acetic, formic and nitric. Nitrate solutions are moderately corrosive, carbonate solutions are not.

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