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METALLIC LEAD PRODUCTS DIVISION

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CHEMICAL BULLETIN NO. 32

SUBJECT: REPRINTS FROM CRITICAL CONVERTERS

To Members of the Metallic Lead Products Division:

Attached are two copies of reprints from the "Corrosion Forum" section of CHEMICAL ENGINEERING, November and December, 1949 issues, discussing the performance of lead in contact with fluorine and caustic soda.

They are the tenth and eleventh in a series of articles, the first nine of which were covered by Chemical Bulletin Nos. 2, 9, 19, 20, 24, 25, 26 and 31.

Very truly yours,

Robert L. Gaggin

Secretary

N3080

Fluorine versus ● ● ●

Lead

KENNETH H. ROLL, Lead Industries Assn., New York, N. Y.

In contact with fluorine gas, particularly in the presence of moisture, lead is transformed into the fluoride. Behaving somewhat like lead sulphate, the fluoride coating or film on the lead surface prevents or substantially decreases further reaction. At temperatures up to at least 100 deg. C., lead is known to handle fluorine gas safely.

Lead fluoride is soluble in nitric acid or sulphuric acid, insoluble in acetic acid, hydrofluoric acid or ammonia. Its solubility in water at 20 deg. C. is 0.064 g./100 ml.

Often when fluorine encounters lead, it is only a minor constituent of other corrosive gases. Many ore roasting operations, for example, frequently evolve fluorine gas along with sulphur dioxide and other gases. In the recovery of these gases, particularly when converting to sulphuric acid, lead lined ducts and chambers are often employed. A large Belgian zinc ore roasting plant purges fluorine from its roaster gases by means of several types of lead equipment, all of which have performed successfully for many years.

Fluorine removal is necessary in order to assure purity of the sulphur dioxide before conversion to sulphuric acid by the contact process. From the roasters, the hot gases containing fluorine are conveyed through water cooled lead coils and thence through lead ducts into the defluorinating chamber. The latter is lined with sheet lead and constructed in such a manner that the fluorine is removed by solution in a water spray. The use of lead in handling hydrofluoric acid, one of the products of this reaction, was described in these columns in October.

Lead is regularly used as a washer in an adaptor assembly for external connections to the cylinder valves in use with compressed fluorine.

It thus appears that an important but restricted usage of lead is found in industry for combating corrosion by fluorine under various conditions of concentration, temperature and moisture content

Reprinted from *Chemical Engineering*, November 1949

Caustic Soda versus •••

Lead

KENNETH H. ROLL, *Lead Industries Association, New York, N. Y.*

Lead is amphoteric and reacts with aqueous solutions of caustic soda to form plumbites. Because the plumbites formed are soluble in the caustic solution they cannot provide a protective surface film on the lead. However, for certain purposes or under special conditions corrosion rates are tolerable with sodium hydroxide up to 30 percent concentration at 25 deg. C. and up to 10 percent concentration at 90 deg. C. For example, lead has proved useful in the refining of petroleum where a sulphuric acid treatment is followed by an alkaline solution treatment in the same lead-lined vessel. Below are shown the results of tests by Calcott and Whetzel in which lead was exposed to a 25 percent solution of caustic soda at various temperatures:

Temperature, Deg. C.	Corrosion Rate, Mils Per Yr.
[illegible]	[illegible]

The table below illustrates the effect of varying concentration and temperature of caustic soda to which lead is exposed:

	Corrosion Rates, Mils Per Yr.	
	20 Deg. C.	100 Deg. C.
[illegible]	[illegible]	[illegible]

The results of these tests show that cold, concentrated solutions of caustic soda have far less effect on lead than hot, dilute solutions. Except for the latter conditions, none of the results indicate that lead could not be used for handling the solutions tested.

Other tests have been conducted to show the effects of aeration on the corrosion rate of lead in a 1 N solution of sodium hydroxide at room temperature. Tests were run for two days following a previous two-day exposure. Here are the results:

	Corrosion Rate, Mils Per Yr.
Total Immersion	
Cyclic	[illegible]
Continuous	[illegible]
Alternate Immersion	
[illegible]	[illegible]
[illegible]	[illegible]
Spray (90 deg.)	[illegible]

In a series of comprehensive tests conducted by Watts and Whipple lead was exposed to a 1 N solution of sodium hydroxide and results compared with lead exposed to the same solution but containing additional small amounts of such salts as sodium arsenate, potassium permanganate, potassium nitrate and sodium chlorate. It was found that all of these oxidizing agents reduced the rate of corrosion instead of accelerating it. While the test data reported here are not wholly consistent, the trends appear clear.

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