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SOLDERING FLUX COMPOSITION

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This invention relates to soldering flux compositions and more particularly to an aqueous fluxing solution for use in the metal-working arts for purposes such as tinning steel, soldering various metals such as copper, brass, galvanized pipe and black pipe, and the like.

One of the objects of the invention is to provide an improved soldering flux composition which is convenient to handle and use and effective in removing surface contamination from and cleaning the metal surfaces to be soldered or otherwise treated.

Another object is to provide an improved soldering flux composition having good detergent and emulsifying properties for the removal of greasy materials from the surfaces to be cleaned and soldered.

A further object is to provide an improved soldering flux composition capable of converting metallic surface contaminants into metal compounds soluble in aqueous media and hence easily removable from the surfaces to be cleaned and soldered.

A still further object is to provide an improved soldering flux composition of the type characterized in the preceding objects which is also adapted to minimize if not prevent entirely the occurrence of acid conditions at the soldered joint.

Fluxing compositions embodying the invention comprise an alkanolammonium salt of an alkyl benzene sulfonic acid together with a substantial excess of alkanolamine, the composition being dissolved in water to form an aqueous fluxing solution of suitable concentration for application to the surfaces to be cleaned and soldered.

The alkyl group or groups attached as side chains to the benzene nuclei of the sulfonic acid may be either straight chain or branched chain radicals and may be of any suitable length up to about 18 carbon atoms. However, longer side chains generally increase the effectiveness of the composition to some extent and hence are preferred. For example, good results have been obtained with toluene sulfonic acid, as well as with sulfonic acids containing larger alkyl groups such as amylbenzene sulfonic acid and dodecylbenzene sulfonic acid. It will be understood that commercial alkylbenzenes can be used in which there may be considerable variation in the side chains. Thus in commercial amylbenzene, the side chain may be largely the iso compound; commercial dodecylbenzene has a side chain made up of polymerized propylene and therefore branched, while only about 90% of the material

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has a side chain equivalent to C₁₂, the remainder being C₉ and C₁₅ with probably some C₁₈. For practical reasons, the use of alkylbenzenes having side chains averaging more than 18 carbon atoms is undesirable.

The alkanolamines preferred for use in the invention include the ethanolamines and the isopropanol amines and may be primary, secondary, or tertiary, although in general the tertiary compounds are preferred. The alkanolamine neutralizes the sulfonic acid, forming its alkanolammonium salt. It is important for reasons explained below to use a substantial excess of alkanolamine above the amount required for such neutralization. Preferably the proportions of sulfonic acid and alkanolamine should be of the order of one mole of acid to at least two moles of alkanolamine, but the proportion of alkanolamine can be substantially reduced, say to 1½ moles or even less, while on the other hand it can be increased to three moles or more which may be desirable in some cases in order to obtain a completely liquid product for ease of handling.

The above mentioned fluxing agents are applied to the work in the form of an aqueous solution of suitable concentration. For most purposes, a concentration of 30–60% by weight gives good results, but the amount of water used is not critical and may be either more or less than this range.

While the absolute mechanism of the fluxing action is not completely understood, it is presently believed that the good results obtained with fluxing compositions such as described above are due to the following effects and reactions. The alkanolammonium salts of the alkyl benzene sulfonic acids are good detergents and emulsifying agents and hence effective in removing greasy materials and the like from the surfaces to be cleaned and soldered. On the other hand, the metallic compounds that contaminate the surfaces to be soldered comprise metal oxides and metal salts that are largely inorganic in nature. These compounds react with the fluxing agents to form metal salts of the sulfonic acid, which are soluble in aqueous media in the presence of excess alkanolamine and hence can be removed readily from the surfaces to be cleaned.

The excess alkanolamine also minimizes or prevents the occurrence of acid conditions at the soldered joint. This effect is especially important in soldering wires in electric motors, rheostats, transformers and other electrical equipment where acid conditions generated at the point

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of soldering may cause deterioration of the soldered connections and eventual breakdown. Excess alkanolamine tends to keep the flux from turning acid and to prevent the occurrence of acid conditions at the soldered joint. To be on the safe side, sufficient alkanolamine may be used to keep the system neutral or slightly alkaline even though all of the sulfur in the sulfonic acid should be converted to sulfuric acid as the result of thermal decomposition.

The following are typical examples of fluxing solutions embodying the invention that have been used with good results:

Dodecylbenzene sulfonic acid -----	Moles	15
Triethanolamine -----		2
Water to form 30-60% solution.		
Dodecylbenzene sulfonic acid -----	1	20
Diethanolamine -----	2	
Water to form 30-60% solution.		
Dodecylbenzene sulfonic acid -----	1	
Monoethanolamine -----	2	25
Water to form 30-60% solution.		
Amylbenzene sulfonic acid -----	1	
Triethanolamine -----	2	
Water to form 30-60% solution.		
Toluene sulfonic acid -----	1	30
Triethanolamine -----	3	
Water to form 50% solution.		
Dodecylbenzene sulfonic acid -----	1	
Monoisopropanolamine -----	2	35
Water to form 50-60% solution.		

(NOTE.—This particular mixture is somewhat gelatinous, but nevertheless effective as a flux.)

Dodecylbenzene sulfonic acid -----	Moles	40
Monoisopropanolamine -----		3
Water to form 30-60% solution.		

(NOTE.—This mixture is completely liquid, and is preferred to the preceding composition because of greater ease of handling.)

Dodecylbenzene sulfonic acid -----	Moles	1
Diisopropanolamine -----		2
Water to form 40-50% solution.		
Dodecylbenzene sulfonic acid -----	1	50
Triisopropanolamine -----	2	
Water to form 40-50% solution.		

It will be understood that the invention is not restricted to the details particularly set forth in the foregoing description and examples, and that various other embodiments of the invention may now be devised by those skilled in the art without departing from its spirit. Reference should therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A soldering flux composition consisting essentially of an alkanolammonium salt of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain and excess alkanolamine in the approximate proportions of one mole of acid and from 1½ to about three moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

2. A soldering flux composition consisting essentially of an alkanolammonium salt of an alkyl benzene sulfonic acid having not more than about

18 carbon atoms in the alkyl side chain and excess alkanolamine in the approximate proportions of one mole of acid and two moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

3. A fluxing solution adapted for use in soldering metals and consisting essentially of an aqueous solution of an alkanolamine and an alkanolammonium salt of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain in the approximate proportions of one mole of acid and from 1½ to about three moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

4. A fluxing solution adapted for use in soldering metals and consisting essentially of an aqueous solution of an alkanolamine and an alkanolammonium salt of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain in the approximate proportions of one mole of acid and two moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

5. A soldering flux composition consisting essentially of approximately one mole of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain and about two moles of triethanolamine.

6. A fluxing solution adapted for use in soldering metals and consisting essentially of an aqueous solution of triethanolamine and triethanolammonium salt of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain, said acid and triethanolamine being in the proportions of approximately one mole of acid and from 1½ to about three moles of triethanolamine.

7. A fluxing solution as defined in claim 6, said solution containing from 30% to 60% by weight of said acid and triethanolamine.

8. A soldering flux composition consisting essentially of approximately one mole of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain and about two moles of triisopropanolamine.

9. A fluxing solution adapted for use in soldering metals and consisting essentially of an aqueous solution of triisopropanolamine and triisopropanolammonium salt of an alkyl benzene sulfonic acid having not more than about 18 carbon atoms in the alkyl side chain, said acid and triisopropanolamine being in the proportions of the approximately one mole of acid and from 1½ to about three moles of triisopropanolamine.

10. A fluxing solution as defined in claim 9, said solution containing from 30% to 60% by weight of said acid and triisopropanolamine.

11. A soldering flux consisting essentially of an alkanolammonium salt of an alkyl benzene sulfonic acid having about twelve carbon atoms in the alkyl side chain and excess alkanolamine in the approximate proportions of one mole of acid to two moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

12. A fluxing solution adapted for use in soldering metals and consisting essentially of an aqueous solution containing about 30% to 60% by weight of alkanolammonium salt of an alkyl

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benzene sulfonic acid having about twelve carbon atoms in the alkyl side chain and excess alkanolamine in the approximate proportions of one mole of acid to two moles of alkanolamine, said alkanolamine being selected from the group consisting of primary, secondary and tertiary ethanolamines and isopropanolamines.

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