9 Sizing in acid, neutral and alkaline conditions

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9.1. Introduction

The range of choice available to the papermaker when he goes shopping for a sizing system to waterproof his paper or board is akin to a walk through a large department store. It provokes the ‘shopper’ with clever ideas, new products and surprising uses for old concepts. The imagination is stimulated, but the perennial determination to get value for money is always present. There must be very few mill, technical or production managers who can honestly claim to know all the technology developed as sizing systems.

Certainly, in the last ten years the depth of know-how amongst major sizing chemical suppliers, has reached a level where tailor making a product or system for a particular mill or grade of paper has become the norm rather than the exception. Add to this fact that electronic technology now exists, such that wet-end retention and streaming potential charge can be measured and shown continuously to optimise sizing and retention chemical addition rates, and one can start to understand how difficult it is to know where a mill buyer starts in making an objective choice.

Fortunately, relief is at hand. Another result of greater technology and expertise in the sizing field has been the dramatically increased level of sales and technical support in manpower available to the paper mill, to assist in making the best choice of system.

How does this selection process manifest itself to the customer, eager to find a solution to a pressing sizing problem, at a reasonable cost efficiency per tonne of paper?

Let us take as an example, a hypothetical case of a technical manager of a paper mill calling the sales manager of a major sizing chemical supplier with a sizing problem. The mill must make a grade of paper, with a sizing specification, with a certain furnish. This is the basic starting position in all cases. The sizing supplier starts with a total range of size systems and products to choose from, and by a process of elimination, will finally suggest the most appropriate combination. What are the choices available to the chemical supplier? They fall into two basic broad considerations which can then be split into more specific headings. The two basic concepts are:

(a) product group type
(b) application method
9.2 Product type

9.2.1 Alkyl ketene dimer sizes (AKD)

Sizing with this generic range of products has been available for over 30 years. The product develops sizing by direct reaction with the cellulose fibre, most efficiently in a neutral, or near neutral pH environment, whether added to the pulp stock at the machine wet-end, or in combination with the starch at the size press.

The degree of sizing achieved with AKD at the wet-end is directly related to the retention of the solid wax material. Retention of the AKD can be improved by the use of cationic starch or cationic resins. The starch or resin may be added separately or included in the emulsion with the AKD wax.

The rate of chemical reaction between the AKD and the cellulose can be influenced by the type of cationic resin used, either in the emulsion or added separately to the stock.

9.2.2 Rosin sizes

In contrast to AKD sizing, rosin is not a cellulose reactive material and requires a source of aluminium species to form the actual sizing agent aluminium rosinate.

Rosin will come to the papermaker in two basic forms:

- soap size
- rosin emulsion

A soap size is fully solubilised and highly anionic. The aluminium rosinate is formed at the wet-end when brought in contact with aluminium sulphate (alum) at an acidic pH (4–5). The precipitate is cationic and is highly attracted to the cellulose fibres. Size distribution is poor and worse in high hardness water. Rosin emulsions do not react with alum or polyaluminium chloride (PAC) at the wet-end. The aluminium rosinate is formed in the driers as the emulsion melts and breaks down allowing the rosin to come into contact with the aluminium species. The delayed reaction achieves a better, more uniform sizing coverage on the fibres.

The later reaction of rosin emulsions has two important consequences:

1. As the alum/PAC and rosin do not react at the wet-end, there is no natural self retention. Retention aids should be used to ensure good size retention in the fibre mat.
2. The wet-end pH is not so critical to effective sizing. Consequently, rosin emulsions will be found operating in wet-end systems at much higher pH levels than resin soap sizes.

The second critical chemical in rosin sizing is the source of aluminium ions to