23

Miscellaneous applications of latices

23.1 MANUFACTURE OF VULCANIZED RUBBER THREAD FROM LATICES

23.1.1 Outline of methods which have been proposed for the manufacture of vulcanized rubber thread from latices

Vulcanized rubber thread is a highly elastic thread widely used in the clothing industry for the production of elastic braiding and fabrics to be used for parts of clothing which are required to undergo reversible elastic deformation under relatively low stresses. This type of thread finds widespread application in articles of clothing such as hosiery and underwear. It also finds application in certain types of footwear, in shock cords for parachute harnesses, and in the production of elastic cords and webs for other uses. Prior to being woven into an elastic braid or fabric, it is common practice to wrap the thread spirally with a textile thread.

Various processes have been proposed and used for the production of rubber thread. For many years, such thread was manufactured by cutting from a rubber sheet; thread formed in this way was inevitably of rectangular (usually square) cross-section. The processes of interest here are those in which the thread is manufactured from rubber in the form of a latex. The earliest process proposed for the manufacture of rubber thread from latex appears to have been that patented by Hancock [1] in 1838. A cylinder having a continuous spiral groove cut in its surface was dipped in natural rubber latex, removed, and the excess latex scraped from the surface. The latex which remained in the grooves was dried, and a continuous rubber thread then drawn away after dipping the cylinder in warm water. Little interest was shown in the production of rubber thread from latex until the early 1920s. According to James [2], in an important paper published in 1949, some 58 patents relating to latex thread were granted during the period from 1922 to 1932. Industrial production of
Vulcanized rubber thread from latices

latex thread commenced around 1930. From then on, latex thread became an increasingly important alternative to cut thread. Since the late 1950s, rubber threads made from various polyurethane elastomers have become increasingly important competitors for rubber threads made from more conventional elastomers such as natural rubber. However, whereas cut and latex rubber threads are monofilament, it appears that many, if not all, polyurethane threads are bundles of smaller filaments.

Of the many processes which have been proposed for the manufacture of rubber thread from latex, by far the most important is that in which suitably-compounded latex is continuously extruded through appropriate nozzles into a bath of latex coacervant. Most latex thread has been produced by this type of process; it is probably the only type of process now being used for this purpose. Other methods which have been proposed include:

1. extrusion of a heat-sensitive latex compound through a heated nozzle;
2. extrusion through a cooled nozzle of a latex compound which gels on cooling;
3. extrusion of a viscous latex vertically downwards, relying upon air-drying to set the thread;
4. production from a deposit which has been formed on, and removed from, another surface;
5. production by allowing a heat-sensitive latex compound to be drawn by capillary action into grooves formed in the tops of fins which project from the surface of an internally-heated drum;
6. production by cutting a wide sheet of latex rubber into strips.

An example of a process of type (4) is one in which a wire of pear-shaped cross-section is first dipped into a latex compound. The deposit is then dried, removed from the wire, rolled up and vulcanized. The initial deposit is in the form of a tube which surrounds the wire. The tube is easily removable from the wire, because the latex compound tends to flow away from the sharp edge of the pear-shaped cross-section. In a second process of this type, the latex compound is deposited in grooves which are cut circumferentially in the surface of a cylinder. The excess latex compound is removed, and the deposit dried, vulcanized and removed from the grooves. This process is clearly a development of that originally proposed by Hancock [1] in 1838. In a third process of this type, a ribbon of partially-vulcanized rubber is deposited on a moving tape, and the deposit subsequently removed and rolled up into a thread. Alternatively, the ribbon-like deposit can be pulled through a rotating stainless steel eye to convert it into a thread of circular cross-section. It is understood that a process of type (5) was operated for some time by the American Viscose Corporation. The threads were continuously stripped from the grooves in a wet-gel condition, after which they were stretched to the requisite size. Finally, they were dried and vulcanized by passing over heated drums. It has been claimed that this process is simpler to operate than is the conventional latex extrusion process, and that it is