39.07 - Polyacetals, other polyethers and epoxide resins, in primary forms; polycarbonates, alkyd resins, polyallyl esters and other polyesters, in primary forms.

3907.10 - Polyacetals

3907.20 - Other polyethers

3907.30 - Epoxide resins

3907.40 - Polycarbonates

3907.50 - Alkyd resins

3907.60 - Poly(ethylene terephthalate)

3907.70 - Poly(lactic acid)

- Other polyesters :

3907.91 - - Unsaturated

3907.99 - - Other

This heading covers :

(1) **Polyacetals**. Polymers obtained from an aldehyde, normally formaldehyde, and characterised by the presence of acetalfunctions in the polymer chain. They are not to be confused with the polyvinyl acetals of **heading 39.05**, in which the acetal-functions are substituents on the polymer chain. This family of plastics includes acetal copolymers and is regarded as engineering plastics, being used for ring bearings, cams, automobile instrument housings, doorknobs, pump and air impellers, shoe heels, mechanical toys, plumbing fittings, etc.

(2) **Other polyethers**. Polymers obtained from epoxides, glycols or similar materials and characterised by the presence of ether-functions in the polymer chain. They are not to be confused with the polyvinyl ethers of **heading 39.05**, in which the ether-functions are substituents on the polymer chain. The most important members of this group are poly(oxyethylene) (polyethylene glycol), polyoxypropylene and polyphenylene oxide (PPO) (more correctly named poly(dimethylphenylene-oxide)). These products have a variety of uses, PPO being used, like the polyacetals, as engineering plastics, polyoxypropylene as an intermediate for polyurethane foam.

This heading also covers pegylated (polyethylene glycol (or PEGs) polymers) derivatives of products of Chapter 29 (Sub-Chapters I to X and headings 29.40 and 29.42).

Pegylated products whose non-pegylated forms are classified either in Chapter 29 (headings 29.36 to 29.39 and 29.41) or in Chapter 30 are excluded and in general remain classified in the same heading as their non-pegylated forms.

(3) **Epoxide resins**. Polymers made, for example, by condensing epichlorohydrin (1-chloro-2,3-epoxypropane) with bisphenol A (4,4'-isopropylidenediphenol), novolak (phenolic) resins or other polyhydroxy compounds or by epoxidising unsaturated polymers. Whatever the basic structure of the polymer, these resins are characterised by the presence of reactive epoxide groups which allow them to be readily cross-linked at the time of use, e.g. by the addition of an amino compound, an organic acid or anhydride, a boron trifluoride complex or an organic polymer.

Epoxide resins range from low viscosity liquids to high melting solids; they are used as surface-coatings, as adhesives, as moulding or casting resins, etc.

Epoxidised animal or vegetable oils are classified in **heading 15.18**.

(4) **Polycarbonates**. Polymers obtained, for example, by condensing bisphenol A with phosgene (carbonyl chloride) or diphenyl carbonate and characterised by the presence of carbonic ester-functions in the polymer chain. These have a number of industrial applications, particularly in moulded articles and as glazing.

(5) **Polyesters**. These polymers are characterised by the presence of carboxylic ester functions in the polymer chain and are obtained, for example, by condensation of a polyhydric alcohol and a polycarboxylic acid. They are thus distinguished from polyvinyl esters of **heading 39.05** and polyacrylic esters of **heading 39.06**, in which the ester groups are substituents on the polymer chain. Polyesters include :

(a) **Alkyd resins**. Polycondensation products of polyfunctional alcohols and polyfunctional acids or their anhydrides, one of which at least must be partly or wholly tri- or higher functional, modified with other substances such as fatty acids or animal or vegetable oils, monofunctional acids or alcohols, rosin. They do not include oil-free alkyds (see Item (e) below). These resins are used mainly as coatings and in high grade varnishes and are supplied usually in viscous form or solution.

(b) **Polyallyl esters**. A special class of unsaturated polyesters (for the term " unsaturated " see Item (e) below) derived from esters of allyl alcohol with dibasic acids, for example, diallyl phthalate. They are used as laminating adhesives, coatings, varnishes and in applications requiring microwave transparency.

(c) **Poly(ethylene terephthalate) (PET)**. Polymer generally formed by the esterification of terephthalic acid with ethylene glycol or obtained from the reaction of dimethyl terephthalate with ethylene glycol. Apart from its very important use in textiles, it finds application, for example, in packaging films, recording tapes, soft-drink bottles.

(d) **Poly(lactic acid)**, also known as **polylactide**. It is usually produced from lactic acid obtained synthetically or by fermentation (this method uses raw materials consisting predominantly of hexoses or compounds which can be easily split into hexoses, e.g., sugars, molasses, sugar beet juice, sulphite liquors, whey or starches). The lactic acid is converted to a cyclic lactide dimer, the ring structure of which is opened during the final polymerisation step. Its applications include textile fibres, packaging materials and materials for medical use.

(e) **Other polyesters**. These may be unsaturated or saturated.

Unsaturated polyesters are those which possess sufficient ethylenic unsaturation that they can readily be (or already have been) cross-linked with monomers containing ethylenic unsaturation to form thermosetting products. Unsaturated polyesters include polyallyl esters (see Item (b) above) and other polyesters (including oil-free alkyds) based on an unsaturated acid, for example, maleic or fumaric acid. These products, which are usually in the form of liquid prepolymers, are mainly used for producing glass fibre reinforced laminates and cast transparent thermosetting products.

Saturated polyesters include polymers based on terephthalic acid, for example, poly(butylene terephthalate), and saturated oil-free alkyd resins. They are largely used for textile fibres and films.

For the classification of polymers (including copolymers), chemically modified polymers and polymer blends, see the General Explanatory Note to this Chapter.