

Attachment II

Lubricating Oil Copolymerization

(Leuna Works, January 12, 1942)

Lubricating Oil Copolymerization.

The essence of the copolymerization process consists of the common reaction of natural and synthetic lubricating oil hydrocarbons. Starting materials are the lubricating oil fractions of petroleum and the synthetic polymer of ethylene or of cracked wax. It is important for the success of the reaction to obtain practically complete removal of asphalt, resins, and wax from the natural lubricating oil fractions and also to employ the synthetic polymer just as formed while it still contains aluminum chloride. The lubricating oil fraction is derived from crude oil by means of vacuum distillation and processed normally in the following manner:

- 1) The crude lubricating oil fraction is deasphalted and deresined with liquid propane.
- 2) The lubricating oil fraction purified in the above manner is dewaxed by one of the well known solvent processes: propane, benzene-acetone, or ethylene chloride.
- 3) The lubricating oil fraction thus freed of asphalt, resins, and wax is extracted with a selective solvent such as phenol or furfural. Olefinic and aromatic hydrocarbons are thus removed while these in turn act as solvents for naphthenic and paraffinic hydrocarbons; an extract is thus obtained containing all four types of hydrocarbons. The depth of extraction is adjusted according to the desired quality of the end product and according to the chemical composition of the crude oil taken. For German paraffinic lubricating oils, the quantity of extract amounts to about 10 to 20 per cent if motor oils are being produced and about 30 to 40 per cent when aircraft oils are desired (on the basis of the lubricating oil fractions taken which have already been processed according to 1 and 2).

For the copolymerization process, Step No. 3 (namely, the extraction) is omitted. When an aircraft oil is being prepared, the 30-40 per cent of extract hydrocarbons mentioned above remain in the lubricating oil fraction which has been processed according to 1 and 2. This is heated to about 100-120°C and then placed in a non-pressured agitator together with the crude ethylene polymer taken directly from the autoclave at the reaction temperature and still containing aluminum chloride. The two products are then stirred together for three or four hours at the same temperature.

The olefins and aromatic hydrocarbons of the natural lubricating oil fraction react with the ethylene polymer under the influence of aluminum chloride. The copolymer obtained is then processed in the same manner as generally

employed for straight ethylene polymer. The weight ratio of natural lubricating oil hydrocarbons to ethylene polymer employed amounts to 1:1 in the preparation of aircraft oils and 2:1 or 3:1 for motor oils. The following advantage was shown in service by an aircraft oil copolymer as compared with a simple physical mixture of equal parts of finished ethylene polymer SS 906 and a purified mineral lubricating oil fraction refined by extraction in the usual manner.

SS 906 + lubricating oil raffinate (1:1) gives
an operating time of 13 hours.
Copolymer (1:1) gives an operating time of
18 1/2 hours.

The copolymerization process thus not only achieves better utilization of natural lubricating oil but also provides a more valuable product.