PRODUCTION OF ELECTRODE COKE FROM HEAVY RESIDUES FROM MANGYSHLAK CRUDE OIL

N. K. Podlesnyi, P. K. Zmievskii, M. G. Mitrofanov, M. D. Shapiro, and P. A. Derekh

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The disadvantages of operating coker units on heavy residues from Mangyshlak crude include low yields of electrode coke, high contents of volatile components in the coke, and short runs between shutdowns for maintenance and turnaround. For example, in a 21-10/300 unit operating with a recycle coefficient of 1.05-1.1, the yield of electrode coke is 28-29%, and contents of more than 9% volatile components in the coke are not at all unusual, 9% being the maximum allowed by the specification for Grade II coke from delayed coking, GOST 15839-70.

The probable cause of the low coke quality is the unsatisfactory thermal regime of the coking chambers. With a normal temperature of 455-500°C for the feed as it leaves the furnace, the temperature of the vapors leaving the top of the reactor is some 15-20°C lower than when operating on residues from the other crudes. Increasing the temperature to which the feedstock is heated is not a feasible way to improve the operating indices of the units, as this leads to rapid coking of the reaction coil.

It was of interest to study the mechanistic features in the coking of feedstock derived from Mangyshlak crude, with the aim of developing and introducing measures to improve the operation of delayed coking units. The feedstocks tested were a cracked tar, a residue from visbreaking, a straight-run tar from Mangyshlak crude, and a mixture of a cracked tar from Mangyshlak crude and an extract from Duo-sol treatment of a straight-run tar from Volgograd crudes. The study was performed in a laboratory 1-liter coking still. The still, with a given feedstock, was placed in a crucible furnace that had been heated to the required temperature. The start of coking was indicated by the appearance of distillate in the receiver. The experiment was continued until the residue temperature had reached 464°C (corresponding to the average temperature of the coke in the chamber of a commercial coker), after which the still was removed from the furnace and cooled. Records were kept on the coking time, the still and furnace temperatures, and the volumes of distillate and gas that were evolved. After each experiment, the distillate density, coke yield, and volatile content of the coke were determined.

Curves are shown in Fig. 1 for the variation of residue temperature with coking time. A drop in temperature is characteristic, and this becomes more pronounced as the coking time is increased. The greatest drop in temperature is observed with the cracked tar; the addition of 25% extract from Volgograd crudes to the cracked tar eliminates the temperature dip completely and shortens the coking time (see Fig. 1b). In a coking experiment on the cracked tar, samples were drawn at intervals corresponding to the temperature drop, and the carboid contents of these samples were determined. The results of this study are shown in Fig. 2. It will be seen that the moment of temperature drop corresponds to an intensive formation of carboids (up to 75%). The characteristic temperature drop as the residue changes from a liquid to a solid is evidence of an increase in the role of decomposition reactions, which, as is well known, proceed with the absorption of heat. The negative heat effect at the moment of forming carboids in coking heavy residual stocks from Mangyshlak crude can be explained by the particular nature of the molecular structure of the asphaltic-resinous substances, in which hydrocarbon groups of aliphatic structure are predominant. The addition of the extract from Volgograd crudes to the Mangyshlak petroleum feedstock changes the heat balance of the destructive conversions by increasing the role of condensation and cross-linking, which proceed with the evolution of heat. These data and this line of reasoning can be used to explain the undesirably low temperatures in the Lower-Volga Branch of Grozny Petroleum Scientific-Research Institute. Translated from Khimiya i Tekhnologiya Topliv i Masel, No. 2, pp. 21-23, February, 1974.

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Fig. 1. Temperature variation in coking residual stocks in laboratory still: a) cracked tar from vacuum distillates + reduced crude; b) same + 25% Duo-sol extract from Volgograd crudes; c) straight-run tar from Mangyshlak crude; d) residue from tar visbreaking. Furnace outlet temperatures: 1) 740°C; 2) 700°C; 3) 660°C; 4) 610°C.

Fig. 2. Variation in temperature (1) and carboid content of residue (2) in coking Mangyshlak cracked tar in laboratory still.

Fig. 3. Content of volatile components in laboratory-still coking: 1) cracked tar; 2) cracked tar + 25% Duo-sol extract; 3) straight-run tar; 4) residue from visbreaking.