MODERN PROPANTS AND THEIR USE IN HYDRAULIC FRACTURING

Researcher **N.A. Bayrayeva**
DSc, Senior Researcher **F.G. Khomidov**
DSc, Professor **B.Z. Adizov**
Institute of General and Inorganic Chemistry, Academy of Sciences of the Republic of Uzbekistan
e-mail: nasibabayrayeva@gmail.com

Abstract: *In this paper, modern types of propants used in hydraulic fracturing, their main properties and usage features are considered. Quartz sands and ceramic propants of various strengths are analyzed, as well as their effect on crack conductivity and hydrocarbon production efficiency. Special attention is paid to the physical and mechanical characteristics of propants: strength, density, granule size, sphericity, and fracture resistance. The advantages of lightweight and resin-coated propants are considered, as well as the conditions for their effective use, depending on depth and reservoir pressure. It is shown that the use of modern high-strength propants makes it possible to increase the efficiency of hydraulic fracturing and increase oil and gas production.*

Keywords: *propane, hydraulic fracturing, quartz sand, ceramic propane.*

Modern materials used to fix fractured hydraulic fracturing in the open state are called propants. The main types of propants are quartz sands and synthetic ceramic propants of medium and high strength. Their main task is to maintain the conductivity of the crack after hydraulic fracturing, which ensures stable movement of oil and gas to the well [1].

In the early stages of the development of hydraulic fracturing technology, various substances were used as wedging materials: glass beads, steel shot, crushed coke, granular ash waste, pulverized coal, silicon carbide and other materials. However, quartz sand has become the most widespread due to its accessibility, low cost and suitability for most types of formations. In addition, quartz sand is able to maintain sufficient permeability even with partial destruction of granules [2].

The main disadvantage of quartz sand is its low mechanical strength. At great depths and high pressures, the sand granules collapse, which leads to the closure of cracks and a decrease in reservoir permeability. Therefore, the use of sand is effective mainly at depths up to 2300-2500 m.

Ceramic propants with high strength and fracture resistance are used for deep formations. Unlike quartz sand, ceramic granules form a small number of large fragments during fracture, which makes it possible to maintain acceptable crack conductivity [3].

The physical characteristics of propants that affect crack conductivity include parameters such as strength, granule size and granulometric composition, quality (presence of impurities, solubility in acids), granule shape (sphericity and roundness), and density.

Indicator	*The norm for fractions*					
	*10/14**	12/20	*12/18**	*16/20*	*16/30*	*20/40*
Bulk density, g/cm, max	*1,9*	*1,9*	*1,9*	*1,9*	*1,9*	*1,9*
Crushing resistance (mass fraction of crushed granules), %, max	*25*	*25*	*25*	*25*	*25*	10
At pressure p.s.i. (MPa)	*7500 (52)*	10000 *(69)*	10000 *(69)*	10000 *(69)*	10000 *(69)*	10000 *(69)*
Solubility in acids, %, max	8	8	8	8	8	8
Sphericity, not less than	*0,7*	*0,7*	*0,7*	*0,7*	*0,7*	*0,7*
Roundness, not less than	*0,7*	*0,7*	*0,7*	*0,7*	*0,7*	*0,7*

The most important parameter is the compressive strength, which determines the propane's ability to withstand rock pressure without breaking. Depending on the depth of the formation, different types of propants are used.:

• quartz sands — up to 2500 m;
• medium strength propants — up to 3500 m;
• high—strength propants - over 3500 m.

Studies show that the use of ceramic propants of medium strength is economically effective even at relatively shallow depths, since an increase in oil production compensates for the higher cost of the material.

In practice, propants of the 20/40 mesh fraction are most often used. Fractions of 12/20, 16/20 and 40/70 mesh are also used. The size of the granules significantly affects the properties of the propane packaging. Large granules provide high crack permeability, but their transportation through the crack is difficult, and the strength decreases with increasing size of the granules.

The shape of the granules also plays an important role. High sphericity and roundness contribute to a denser packing of propane and a reduction in filtration resistance. The density of the propant affects its transport by the rupture fluid. Highly viscous liquids or an increase in the injection rate are required to transport heavy propants.

In recent years, lightweight propants with a reduced density have become widespread. One of the promising materials is kaolin propane, which reduces energy consumption and the cost of hydraulic fracturing. Due to its high strength, bauxite propants are used in ultra-deep wells and at high temperatures.

Modern technologies also provide for the use of resin-coated propants. The polymer coating increases the strength of the granules and prevents the removal of destroyed particles from the crack, which helps to maintain its conductivity for a long time.

REFERENCES:

1. Tang Y., Ranjith P.G., Perera M.S.A. Major factors influencing proppant behavior and associated damage mechanisms during hydraulic fracturing. Acta Geotechnica. 2018. Vol. 13. P. 757–780.
2. Zhu J., Li F., Li X., Yang Z., Liao Z., Zhang J., Dorosti F., Wang H., Ge L. Valorization of aluminum–silica-based industrial solid waste to high-quality ceramic proppants: Waste sources and design strategies. Journal of Cleaner Production. 2026. Vol. 546. P. 147800.
3. Ren Y., Ren Q., Huo Z., Wu X., Zheng J., Hai O. Preparation of glass-shell fly ash–clay-based lightweight aggregate with low water absorption using sodium carbonate solution as a binder. Materials Chemistry and Physics. 2020. Vol. 256. P. 123606.