IDENTIFICATION AND CONTROL OF THE POLYOLEFIN CODE ON THE COMMERCIAL NOMENCLATURE OF FOREIGN ECONOMIC ACTIVITY

Abstract: It is established that the studied samples of polypropylene goods contain different types of organic and macromolecular structures. The ratio of substances in the composition of polyethylene materials was identified using IR spectroscopy, density, MFR. As a result, we recommended new CN FEA code numbers for polypropylene to protect Uzbekistan’s economic interests in international relations.

Key words: Commercial nomenclature of foreign economic activity, export-import, polyolefin, stereoisomers of polypropylene, identification, IR spectroscopy, melting point, density.

Language: English

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Introduction

Polyolefin penetrated all the dominant sectors of the economy: electronics, electrical engineering, mechanical engineering, automotive, instrument making, transportation, construction. Today, the chemical industry of Uzbekistan, with significant production, raw materials and scientific and technical potential, is one of the leading basic sectors of the country’s economy. According to experts, the estimated annual growth rate of the global chemical industry will be 2.7%, and by 2030 the global market for chemical products will reach 4391 thousand billion US dollars. [1]

In Uzbekistan, polypropylene consumption is growing year after year. Polypropylene export in 2018 amounted to 23,443.4 tons (25,459.5 thousand US dollars). And also, the import of polypropylene in 2018...
The identification and classification of polypropylene in primary forms and products made of them is in most cases accompanied by the involvement of experts or qualified specialists in the relevant field of knowledge, since the code control of such goods according to the HS of the Republic of Uzbekistan is difficult due to the specificity of the classification criteria and the lack of a comprehensive information base.

### Table 1.

| Export | 3902100000 – Polymers of propylene or other olefins in primary forms: polypropylene |
|--------|----------------------------------------------------------------------------------|
|        | 2016 y. | 2017 y. | 2018 y. |
| number, in tons. | thousand dollars USA | number, tons. | thousand dollars USA | number, tons. | thousand dollars USA |
| 60 628,7 | 47 291,3 | 49 992,3 | 44 743,5 | 23 443,4 | 25 459,5 |

| Import | 3902100000 – Polymers of propylene or other olefins in primary forms: polypropylene |
|--------|----------------------------------------------------------------------------------|
|        | 2016 y. | 2017 y. | 2018 y. |
| number, in tons. | thousand dollars USA | number, tons. | thousand dollars USA | number, tons. | thousand dollars USA |
| 65 591,8 | 93 293,3 | 47 653,6 | 52 531,8 | 36 977,0 | 49 752,2 |

Today there are several varieties of polypropylene, all of them have the same formula, but differ in spatial molecular structure: isotactic, syndiotactic, atactic.

The stereoisomers of polypropylene (isotactic, syndiotactic, atactic and stereoblock) significantly differ in mechanical, physical and chemical properties.

Atactic polypropylene is a rubbery product with high fluidity, melting point ~ 80 °C, density 0.85 g / cm3, it is well soluble in diethyl ether and in cold k-hexane.

Isotactic polypropylene in its properties compares favorably with atactic; in particular, it has a higher modulus of elasticity, a higher density (0.90-0.91 g / cm3), a high melting point (165-170 °C) [6], better resistance to chemicals, etc. n. In contrast to the atactic polymer, it is soluble only in certain organic solvents (tetra line, decal in, xylene, toluene), and only at temperatures above 100 °C. The X-ray stereo block polymer of polypropylene exhibits certain crystallinity, which cannot be as complete as that of purely isotactic fractions, since atactic sites cause disturbances in the crystal lattice. [7]

3.8 billion cubic meters of marketable gas, 387 thousand tons of polyethylene, 83 thousand tons of polypropylene are produced at the Us yurt gas chemical complex at the Surge field. According to international news agencies, the demand for polypropylene - the second most abundant polymer in the world - is increasing by 4-6% annually. In 2017, world consumption of polypropylene exceeded 69 million tons.

At the moment, Uz-Cor Gas chemical complex has produced the following grades of polypropylene (table-2): [8]
Using the Fourier method, IR spectrometry was used to identify the functional groups of stereoisomers of polypropylene (Fig. 1). IR spectra were recorded and processed on a Perkin Elmer Spectrum Version 10.4.3 IR Fourier spectrometer with a resolution of 4 cm\(^{-1}\) in the frequency range from 4000 to 400 cm\(^{-1}\).

### 3 RESULTS ACHIEVED

| Brand | Density, g/cm\(^3\) | Flow rate, g/10min | Melting point, °C | Application |
|-------|----------------------|---------------------|-------------------|-------------|
| **Injection**                          |
| J-150 PP H                             | 0.85–0.95            | 8-12               | 160             | Household goods          |
| J-170T PP H                            | 0.85–0.95            | 23-33              | 160             | General household goods, stationery, disposable syringes |
| J-330 PP B                             | 0.85–0.95            | 3-5                | 160             | Household goods (spoons, cups), stationery, toys |
| J-350 PP B                             | 0.85–0.95            | 8-12               | 160             | Battery cases, housings for household appliances |
| J-360 PP B                             | 0.85–0.95            | 14-22              | 160             | Battery cases, housings for household appliances |
| J-370 PP B                             | 0.85–0.95            | 30-40              | 160             | Large Injection Products, Household Electrical Appliances |
| JM-375 PP-B                            | 0.85–0.95            | 40-50              | 160             | Large Injection Products, Household Electrical Appliances |
| J-550S PP R                            | 0.85–0.95            | 10-14              | 160             | Cosmetic containers, cups, food containers, transparent cases, stationery, disposable syringes, CD/DVD cases, etc. |
| **Blown**                                |
| B-310 PP-B                             | 0.85–0.95            | 0.4-0.6            |                  | Chemical bottles, food trays, etc. |
| B-520 PP-R                             | 0.85–0.95            | 1.8-2.2            | 140             | Gum Bottles, Detergent bottles, Cosmetic Bottles |
| B-320 PP-B                             | 0.85–0.95            | 0.8-1.2            | 160             | Industrial sheets, food packaging trays, etc. |
| **Yarn Fibers**                           |
| Y-120 PP H                             | 0.85–0.95            | 0.8-1.2            | 160~165         | Monofilament yarn |
| Y-130 PP H                             | 0.85–0.95            | 3-5                | 160~165         | Monofilament yarn |
| FR-160 PP H                            | 0.85–0.95            | 15-19              | 155~165         | Multi-thread tapes |
| FR-170H PP H                           | 0.85–0.95            | 24-27              | 155~165         | Multi, BCF, staple fiber |
| **Film**                                |
| FO-130A PP H                           | 0.85–0.95            | 2.8-3.2            | 155~165         | Oriented for General Purpose Films |
| FC-550 PP R                            | 0.85–0.95            | 7-9                | 155~165         | Thermo-adhesive layer for non-oriented films |
| FL-151 PP H                            | 0.85–0.95            | 7-9                | 155~165         | General Purpose IOPP Films, Shrink Films |
| L-270A PP H                            | 0.85–0.95            | 24-28              | 155~165         | Kraft paper coating |

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**Impact Factor:**

- ISRA (India) = 4.971
- ISI (Dubai, UAE) = 0.829
- GIF (Australia) = 0.564
- JIF = 1.500
- ICV (Poland) = 6.630
- PIII (Russia) = 0.126
- ESJI (KZ) = 8.997
- IRN (Russia) = 0.126
- SIS (USA) = 0.912
- SJIF (Morocco) = 5.667
- OAJI (USA) = 0.350

**Philadelphia, USA**
Impact Factor:

- ISRA (India) = 4.971
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- GIF (Australia) = 0.564
- JIF = 1.500
- IS (USA) = 0.912
- ICV (Poland) = 6.630
- РИНЦ (Russia) = 0.126
- PIF (India) = 1.940
- GIF (Australia) = 0.564
- ESJI (KZ) = 8.997
- IBI (India) = 4.260
- SJIF (Morocco) = 5.667
- OAJI (USA) = 0.350

Fig. 1. IR spectra of stereoisomers of polypropylene

4 DISCUSSION

The analysis of the IR spectrum of PP grades showed that in the region of the highest frequencies (2950–2970 cm⁻¹) there are bands corresponding to stretching vibrations of aliphatic CH₃ groups (table-3). Among the various combinations of bands used as isotactic indices, the ratio of peak areas of 998 cm⁻¹ to 973 cm⁻¹ is one of the most common.

| Frequency Range (cm⁻¹) | Attribution                                      |
|------------------------|--------------------------------------------------|
| 2950-2970              | Valence asymmetric vibrations of aliphatic CH₃ groups |
| 2600-3100              | O-H stretching vibrations in H-bonded RC(O)O-H     |
| 1450-1470              | Deformation vibrations of aliphatic CH₂, CH₃ groups |
| ~1240                  | C-O stretching vibrations in CH₃C(O)=OR            |
| 1000-1250              | C=S stretching vibrations                          |
| 985-995                | CH deformation vibrations in RHC=CH₂               |
| 800-900                | Mostly C-C deformation vibrations                 |

To interpret the vibrational spectra of polymers, it is necessary to know the spectral repeating chain link, i.e. such a unit from which the whole macromolecule can be built by certain operations of symmetry. Sometimes this unit coincides with the monomer unit of the chain (isotactic polypropylene), in some cases it contains two monomer units (syndiotactic polypropylene, polycrylonitrile) or includes only
“half” of the small unit (polyethylene). When analyzing the spectrum, it should be borne in mind that the number of characteristic vibrations for a given chemical group will be different depending on whether this group belongs to a polymer or non-polymer molecule. For example, consider the characteristic vibrations of the —CH₂— group. In the non-polymer CH₂Cl₂ molecule, the CH₂ group is characterized by three characteristic vibrations: two stretching vibrations in the range of 2940–2915 cm⁻¹ and 2885–2860 cm⁻¹ and one deformation vibration in the range of 1480–1460 cm⁻¹. In a polymer molecule containing —CH₂— groups, one should expect six characteristic vibrations: twice the number of the three characteristic vibrations mentioned above, polarized, however, in different ways — parallel and perpendicular to the axis of the chain.

The results of experimental work allow us to classify polypropylene in primary forms by molecular structure.

### Table 4. Recommended code numbers for stereoisomers of polypropylene in primary forms according to the Commodity Nomenclature of Foreign Economic Activity (in a new subheading)

| Recommended CN codes | Type of polypropylene | Tₘ, °C | Density, g/cm³ | The density of crystals, g/cm³ | The range of molecular weight distribution, x10³ |
|----------------------|------------------------|--------|----------------|------------------------------|-----------------------------------------------|
| 3902 10 000 1        | Isotactic PP            | 165    | 0.90-0.91      | -0.94                        | 50-630 (1-chloronaphthalene, 145 °C)           |
| 3902 10 000 2        | Syndiotactic PP         | 155    | 0.86-0.89      | 0.93                         | 90-450 (heptane, 30 °C)                        |
| 3902 10 000 3        | Atactic PP              | ~80    | 0.85           | -                            | 20-40 (heptane, 30 °C)                         |

The listed varieties of polypropylene in chemical composition include polypropylene consisting of carbon and hydrogen. However, they differ significantly in molecular weight, structure, density, melting point, price and other properties associated with the conditions of their production, their application areas.

Thus, for the identification and classification of stereoisomers of polypropylene during examination, it is sufficient to test them in accordance with the parameters given in tables 4.

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Impact Factor:

| Journal   | Impact Factor |
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