Alliance standards

AS/CK 3-2020

Jadeite – Testing and Designation

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Foreword

The purpose of this document is to unify the testing methods and nomenclature standards. All parties of the alliance agree with each other on the test results using this document.

This document is drafted in accordance with the rules given in the GB/T 1.1—2020, Directives for standardization—Part 1, Structure and drafting of standards.

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Jadeite - Testing and Designation

1 Range

This document specifies the terms and definitions, identification characteristics and identification methods, designation, certificates and reports of jadeite. This document is applicable to the testing and naming of jadeite products.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest version (including all amendments) is applicable to this document.

GB/T 16552 Gems-Nomenclature
GB/T 16553 Gems-Testing

3 Terms and definitions

The following terms and definitions established in GB/T 16552 and GB/T 16553 are applicable to this document.

3.1 jadeite

It is a mineral assemblage mainly composed of jadeite or jadeite and other sodium mass or sodium calcium pyroxene (such as omphacite, sodium chrome pyroxene) with technological value, which can contain a small amount of amphibole, feldspar, chromite and other minerals. The Mohs hardness is 6.5~7, density is 3.34 (+0.06, -0.09)g/cm³, refractive index is 1.666~1.680 (± 0.008), the result of refractive index using point measure method measured is 1.65~1.67.

3.2 enhancement and treatment

In addition to cutting and polishing, all methods used to improve the appearance and durability or usability of gem and jade, such as improve color, clarity, transparency, luster or special optical phenomena. They are divided into enhancement and treatment.

3.2.1 enhancement

Enhancement are traditional, acceptable optimization method which made the potential beauty of gems and jades visible.

3.2.2 treatment

Treatment are non-traditional and unacceptable optimization method.

3.2.3 bleaching

Using chemical solution soaking gems and jades to light color or remove impurities.

3.2.4 filling or impregnation
Using colorless oil, wax, glass or resin to fill the gaps, (open) gaps, cavities of gems and jades, or fill the gems and jades with multiple pores and cracks in order to improve or change the cleanliness, appearance and durability of gems and jades.

3.2.5 coating
The surface of gems and jades are covered with film by coating and plating to change luster and color, produce special optical phenomena or play a protective role of jewelry.

3.2.6 dyeing
In order to improve or change the color of gems and jades, colorants (such as colored oil, dyes, etc.) are infiltrated into gems and jades.

4 Identification characteristics

4.1 Mineral (rock) composition
It is mainly composed of jadeite or jadeite with other sodium mass or sodium calcium pyroxene (such as omphacite, sodium chrome pyroxene). It can contain a small amount of hornblende, feldspar, chromite, etc.

4.2 Material properties

4.2.1 Chemical composition: jadeite: NaAlSi$_2$O$_6$; it can contain Cr, Fe, Ca, Mg, Mn, V, Ti and other elements.

4.2.2 Crystalline state: crystalline aggregate, it often appears fibrous, granular, or locally columnar aggregates.

4.2.3 color: white, and the various shades of green, yellow, red orange, brown, grey, black, lilac, purple, blue, etc.

4.2.4 Luster: glass luster to grease luster.

4.2.5 Cleavage: jadeite has two group of perfect cleavage, the aggregate shows tiny flash on the cleavage plane, called ‘cuixing’.

4.2.6 Mohs hardness: 6.5~7.

4.2.7 Density: 3.34 (+0.11, -0.09) g/cm³.

4.2.8 Optical characteristic: heterogeneous aggregate.

4.2.9 Pleochroism: the aggregate is unmeasurable.
4.2.10 Refractive index: 1.666~1.690(+0.020, -0.010), the result of refractive index using point measure method measured is usually 1.66. Birefringence: the aggregate is unmeasurable.

4.2.11 Fluorescence observation: none to weak, white, green, yellow.

4.2.12 Ultraviolet visible spectra: the absorption peak at 437 nm; the green jadeite colored by chromium has absorption peaks of 630 nm, 660 nm, 690 nm. See Appendix A for UV Vis spectrogram.

4.2.13 Magnifying inspection: star point, acicular, schistic flash, granular or columnar crystal loblastic texture, fibrous pilotaxitic to granular fibrous texture, enclave.

4.2.14 Infrared spectrum: in the mid infrared region, there are characteristic infrared absorption bands caused by the vibration of Si-O groups in pyroxene (clinopyroxene). The bleached and filled jades have a set of characteristic infrared absorption bands of 2827 cm⁻¹, 2930 cm⁻¹, 2965 cm⁻¹, 3035 cm⁻¹ (nearby), 3055 cm⁻¹ (nearby) and 4062 cm⁻¹ (nearby) in the near-infrared region. The infrared spectra are shown in appendix B.

4.2.15 Special optical phenomena: cat eye effect (rare)

4.3 Enhancement

4.3.1 Heat treatment: heat treatment often used to change the light brown yellow or colorless jades into brown-red and brown-yellow jades. It is difficult to detect.

4.3.2 Bleaching: the sample is only soaked in a mild acid or alkali solution to remove the impurities on the surface, and the structure is not obviously damaged, and there is no filling material for reinforcement. There may be wax treatment on the surface.

4.3.3. Bleaching and filling: The results of magnifying inspection show that the surface is orange peel or ditch like structure; the polished surface has micro cracks, and the internal structure is loose; the polished surface has resin or wax luster; the density and refractive index are lower than the natural samples; there has none or blue-green or yellow green fluorescence under long or short wave ultraviolet light; infrared spectrum test shows the characteristic infrared absorption band of filling materials; luminous image analysis (such as ultraviolet fluorescence view) shows the distribution of filling materials.

4.3.4 Filling: It can be seen that the surface luster of the filling part is different from that of the main jadeite, and bubbles can be seen in the filling part; the characteristic infrared absorption band of the filling material can be seen in the infrared spectrum test; the distribution of fillings can be observed by luminescent image analysis (such as ultraviolet fluorescence detector).

4.3.5 Dyeing treatment: it can be seen from the magnifying inspection that the color distribution is not uniform, and usually concentrates in cracks, interstices or surface depressions; under long or
short wave ultraviolet light, the dye can cause special fluorescence; and the UV visible spectrum is
abnormal (for jadeites which dyed green by chromium salt, the UV visible spectrum can see 650
nm absorption band).

4.3.6 Film covering: It can be seen that the surface luster is abnormal by magnification inspection,
and the film shedding phenomenon can be seen locally; the abnormal refractive index could be seen;
the characteristic peak of the film can be seen by infrared and Raman spectrum tests.

5 Identification method

5.1 Visual inspection
It is determined by visual inspection, including color, shape, transparency, luster, structure, cleavage,
fracture and some internal and external features.

5.2 Routine instrument test
The main contents of the instrument tests are magnifying inspection, refractive index, optical
characteristics, absorption spectrum, ultraviolet fluorescence, density, quality, etc. the method
should meet the requirements of GB/T 16553.

5.3 Special identification methods
The main contents of the special identification method include thermal reaction, chemical reaction,
Mohs hardness, infrared spectroscopy, ultraviolet-visible spectroscopy, laser Raman spectroscopy,
etc. These methods should meet the requirements of GB/T 16553.

5.4 Identification principle

5.4.1 General principle: combine the visual observation, conventional instrument detection and
infrared test results. Comprehensively judging the results of each identification item to ensure the
accuracy and uniqueness of the identification conclusion.

5.4.2 If necessary, other special identification methods can be used to determine.

5.4.3 Due to the inconsistency of sample conditions, some identification items may be omitted.
However, the comprehensive evidence of the results of other appraisal projects should be sufficient
to prove the accuracy of the appraisal conclusions obtained.

6 Name

6.1 The jadeite jewelry without any optimization treatment is directly named jadeite, There is no
need to add the word "natural".

6.2 Enhancement and treatment

6.2.1 Methods and categories of enhancement and treatment
The common enhancement and treatment methods and categories of jadeite are shown in Table 1.

### Table 1 Common enhancement and treatment methods and categories of jadeite

<table>
<thead>
<tr>
<th>Optimize processing method</th>
<th>Optimization processing category</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat treatment</td>
<td>optimization</td>
<td>-</td>
</tr>
<tr>
<td>Bleaching</td>
<td>optimization</td>
<td>notes can be added or not</td>
</tr>
<tr>
<td>Bleaching and filling treatment</td>
<td>Treatment</td>
<td>Bleaching and filling treatment</td>
</tr>
<tr>
<td>Filling</td>
<td>Optimization (notes should be added)</td>
<td></td>
</tr>
<tr>
<td>Film covering treatment</td>
<td>Treatment</td>
<td>Laminating treatment</td>
</tr>
<tr>
<td>Dyeing treatment</td>
<td>Treatment</td>
<td>Dyeing treatment</td>
</tr>
</tbody>
</table>

6.2.2 Enhancement and treatment of representation

6.2.2.1 Enhancement
The representation method of the enhancement should meet the following requirements:

a) The enhanced jadeite is directly named as jadeite, and the specific enhancement method can be explained in the relevant quality documents.

b) The enhanced jadeite (should be noted) is directly named as jadeite. The specific enhancement method should be noted in the relevant quality documents to describe the enhancement degree. For example: "filled" or "slightly/moderately filled".

6.2.2.2 Treatment
The representation method of the treatment should meet the following requirements:
Note in the basic name of jadeite:

---Add specific treatment methods before the name, such as bleached, filled and dyed jadeite.

---After the name, indicate the "treatment" method in the bracket, such as jadeite (film covering), jadeite (dyeing).

---After the name, indicate the "treatment" method in the bracket, such as jadeite (treatment). The specific treatment method should be noted in relevant quality documents, such as bleaching, filling and dyeing.

7 Certificates and reports

7.1 Basic content

The basic content of the inspection report for Jadeite products should include:
---Sample number
---The sample photograph
---Mass or specification
---Result
---Name and purity of precious metal materials (when applicable)
---Inspection basis
---Signatures of the approval personnel
---Laboratory signatures;
---Laboratory qualification and laboratory accreditation, etc.

7.2 The optional contents in the inspection report of jadeite products include:
-- Description of appearance features
-- Density
-- Optical characteristics
-- Refractive index
-- Mohs hardness
-- Ultraviolet fluorescence
-- Magnifying inspection
-- Absorption spectrum
-- Infrared spectrum
-- Ultraviolet visible spectroscopy
-- Laser Raman spectrum
-- Special optical effects and special properties, etc.
Appendix A

(Informative appendix)

UV Vis spectra of various jadeites

A.1 UV-visible spectroscopy

A.1.1 Illustration

A.1.1.1 Instrument test conditions: integration time is 150 s, average times are 30, smoothness is 2, wavelength rage from 225 nm to 1000 nm.

A.1.1.2 Test temperature: 25 ℃~30 ℃

A.1.1.3 Experimental method: reflection method

A.1.1.4 Coordinate directions: the abscissa: wave length (nm), the ordinate: transmittivity

A.1.2 UV-visible spectroscopy of jadeite (see figure A.1~A.6)

A.1 jadeite (green): with 367 nm, 382 nm, 437 nm, 630 nm, 660 nm, 692 nm absorption peak
A.2 Jadeite (white): with 367 nm, 382 nm, 437 nm absorption peak

A.3 Jadeite (violet): with 367 nm, 382 nm absorption peak and 575 nm wide absorption band

A.4 Sodium chrome pyroxene (Tielongsheng): with 450 nm, 650 nm wide absorption band and 692 nm absorption peak
A.5 Synthetic jadeite (green): missing 437 nm absorption peak

A.6 Bleached, filled and dyed jadeite (green): with 437 nm absorption peak and 670 nm wide absorption band, missing 692 nm absorption peak
Appendix B

(Informative appendix)

Infrared absorption spectra of jadeite

B.1 Infrared absorption spectrum

B.1.1 Illustrate

B.1.1.1 The resolution of atlas acquisition is 8 cm$^{-1}$
B.1.1.2 The ordinate means that: % transmittance shows the rate of light passes through the sample when plotting; % reflectivity shows the reflection of light on the sample when plotting.
B.1.1.3 All ordinate values of spectrogram are not of reference value on account of effect of actual sample status.

B.1.2 Infrared absorption spectrogram of jadeite (see figure B.1~B.5)

![Infrared absorption spectrogram of jadeite](image1)

B.1 The reflection spectrum of jadeite

![The reflection spectrum of jadeite](image2)

B.2 The transmission spectrum of jadeite

![The transmission spectrum of jadeite](image3)
B.3 The transmission spectrum of jadeite (filled with wax or oil)

B.4 Bleached, filled jadeite (with 4062, 3055, 3035, 2965, 2930, 2872 cm\(^{-1}\))

B.5 Bleached, filled jadeite (filled a lot of glue, with 4060, 4620 cm\(^{-1}\))