

Importance of Emerald Clarity Enhancement: Gübelin Gem Lab standards 祖母綠淨度處理的重要性



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祖母綠普遍都帶有內含物，被譽為「內含物的花園」，祖母綠內含物中的裂縫是其中一種常見的內部特徵。本文概述現今業內祖母綠淨度處理的分級和充填物的類型；提高讀者對充填形式的鑑別和認知，使業界和消費者都得到更好的保障。

Abstract

Emerald is always so full of inclusions that these are called a “*garden of inclusions*” in the trade. Open fissures are a typical such internal characteristic. This article briefly describes the extent of clarity treatment in emerald and various types of filler materials. The authors believe the greater the transparency in the gem trade, the more confidence end-consumers will have.

Introduction

Jardin, “*garden*” in French, is used to describe the profusion of inclusions inside emeralds. As Dr Edward J. Gübelin said, “*the gardens of the emerald awaken the desire to wander at will, delighting eternally in the fantastic, constantly changing wealth of designs in their evergreen vaults.*” Fissures are the most common feature in emeralds, even in high-end specimens. They may reduce the stone’s transparency and durability. Fissure filling, then, becomes “standard” practice, enhancing the visual appearance of emeralds, often dramatically. As early as the early 1990s, clarity enhancement in emerald attracted the attention of the gem industry (Hänni, 1992) and gem labs started to invest in methods to determine the degree of the enhancements and the identification of the filler type (Hänni et al. 1996, Johnson et al. 1999, Kiefert et al. 1999). Since then, this enhancement has become quite well known in the trade and by the public. Given proper disclosure and regular public education, it is now generally accepted as a necessity due to the nature of emeralds.

Disregarding any human impact, e.g., explosives during mining, the formation of fissures in emerald is related to tectonic events affecting

the mother rock in which the emerald is forming. The developing emerald experiences significant mechanical strain, resulting in fissures and fractures throughout the stone. Hence, natural emeralds, regardless of their origins, always contain fissures that may affect the transparency, appearance and durability of the final polished stone. The most common concern in the trade has become the degree of clarity enhancement and then the identification of the filler material. But it is important to note that it cannot be the degree of clarity enhancement alone that forms the basis of judgement of the quality or value of an emerald.

The Laboratory Manual Harmonization Committee, LMHC for short, publishes Information Sheets on its website disclosing the agreed terms in use by gem testing laboratories from Asia, Europe, and the United States of America. Information Sheet 5, concerning clarity enhancement in emeralds, was implemented in January 2007. An illustrative diagram is used to explain how the quantification of filler in fissures should be graded. Somewhat similar to clarity grading in diamond, it is based on grading the size, number, location and position of filled fissures in an emerald.

Below are several examples of how to consider those factors in emeralds.

- Fissures or fractures not reaching the surface have no influence on the clarity enhancement grade.
- A filled fissure directly underneath the table of an emerald would have a stronger influence on the clarity appearance of the stone than a filled fissure located near the girdle. Thus the former would get a poorer clarity enhancement grade.
- A stone with a filled fissure parallel to the table would get a poorer enhancement grade than a stone with a filled fissure perpendicular to the table.
- For a stone with filled fissures located in an area where risk of damaging the stone is high, the emerald will get a poorer clarity enhancement grade.

Gübelin Gem Lab Report Standards

At Gübelin Gem Lab, the degree of clarity enhancement is classified into five grades:

- No indications of clarity enhancement (“none”)
- Indications of insignificant clarity enhancement (“insignificant”)
- Indications of minor clarity enhancement (“minor”)
- Indications of moderate clarity enhancement (“moderate”)
- Indications of significant clarity enhancement (“significant”)

Emeralds that are free of any clarity enhancing substance in fissures qualify for a “none” report. The same applies for stones that have a minute amount of filler in fissures, which does not affect the clarity of the stone. Stones with fissures that only contain visible foreign substance such as polishing powder, dried out oil, or otherwise visible matter in the fissures, are also not considered clarity enhanced, and get a “none” grade.

In cases where large fissures or fractures are present in the stone and there is only a minute amount of foreign substance present, which indeed has only a very slight impact on the clarity of the overall appearance of emerald, the enhancement will be classified as “insignificant.”

Gübelin Gem Lab will issue a report stating “minor clarity enhancement” on an emerald, when few fissures have been filled with clarity enhancing material, which cause only a minor improvement of the stone’s clarity.

“Moderate” or even “Significant” clarity enhancement grades are issued for major filling of important fissures and/or many enhanced fissures throughout the stone.

For emeralds that are found to show no indications of clarity enhancement, Gübelin Gem Lab will issue one of two types of Information Sheet together with each lab report. These are :

A) For emeralds showing surface-reaching fissures, the respective Information Sheet states:

“... By filling these fissures and fractures with a foreign substance such as oil, resin or wax, the transparency of the emerald can be enhanced. Such a clarity enhancement process is usually reversible and repeatable at any time. At the time of the analysis, the emerald described in the above mentioned Gübelin Gem Lab report did not show any indication of clarity enhancement”.

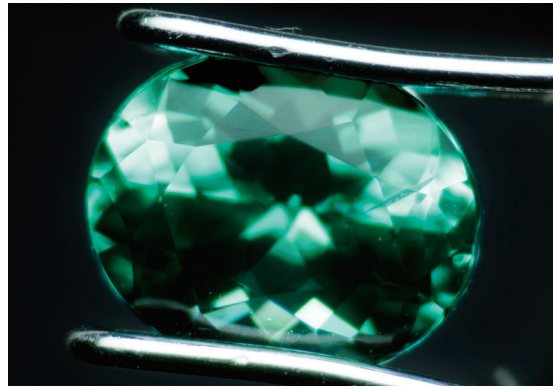


Fig. 1 Eye visible open fissure on crown (right) extending to table is considered an improvement effect on the appearance. 從冠部伸延至枱面右邊，肉眼可見的開口裂縫，被評為對其外觀會帶來影響的淨度優化等級。

B) A very small number of emeralds show no surface-reaching fissures whatsoever, even under detailed microscopic observation. These fissures (Fig. 2) are immune to any clarity enhancement. The respective Information Sheet states the following:

“ ... This emerald is virtually free of fissures and fractures and is thus not susceptible to clarity enhancement. Such emeralds are very rare”.

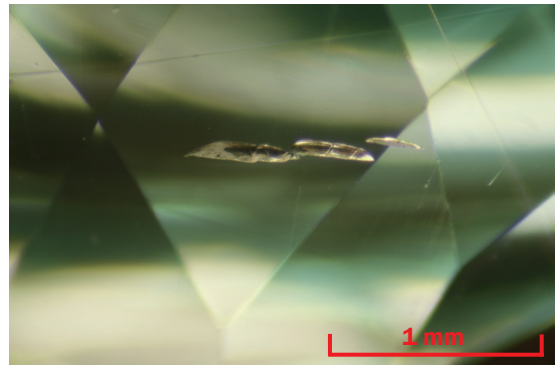


Fig. 2 Three shallow open fissures on crown with a total length of about 1 mm are considered to have no influence on the appearance of the stone.

在冠部的三個淺層開口裂縫，其總長度約為1毫米，被評為對其外觀不會帶來影響的淨度優化等級。

Services provided by the Gübelin Gem Lab

Over the last few years, the enormous number of emeralds without indication of clarity enhancement (“none”) has caused a great deal of consternation in the gemstone industry. With an increase in demand for untreated emeralds, the demand for lab reports stating “none” has increased dramatically.

It is important to note that clarity enhancement on emerald is not permanent, but reversible and repeatable. The filling material — in fact, every type

of filling material – can be removed, and again filled. This implies that the clarity enhancement grade stated on the lab report has limited validity. One cannot exclude the possibility that a stone is cleaned before lab testing, in order to get a favourable lab report, and filled again afterwards, to enhance its appearance. If such a refilled stone were presented or sold to a buyer together with the “old” lab report, this would be strongly misleading. Such practice is unethical and illegal and ultimately self-defeating.

To mitigate this risk, the Gübelin Gem Lab has been offering Integrity Checks free of charge for several years now. Clients can present an emerald and the respective report to the Gübelin Gem Lab, to make a short informal check to see if the status of the stone is in line with the status described on the report. This Integrity Check helps keep possible fraudulent practices at bay.

To document the status of a clarity enhancement call, the Gübelin Gem Lab creates an individual plotting of the filled fissures for each emerald, as well as inclusion photographs.

In consideration of consumers’ request for full disclosure, the type of filling material used for clarity enhancement can also be determined. Identification is done by using instruments such as FTIR spectroscopy or Raman spectroscopy in comparison with oil and resin reference spectra. Gem labs typically distinguish between oil, wax or resin. The filling material does not substantially

affect the degree of clarity enhancement. However, due to the differences in volatility and viscosity, the type of filling material influences the longevity of the clarity enhancing effect, and the ease of removing the substance from the fissures. For these reasons, the Gübelin Gem Lab changed its policy back in 2018 and is now offering the determination of the type of filling material when requested by the client.

We believe that proper disclosure of treatments and integrity checks help dealers and retailers to maintain both better transparency in the trade and the trust of the end consumer.

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Emerald: determination of the type of filler material(s)

The practice of enhancing the visual appearance of emeralds by filling surface reaching fissures with oil or resin is a standard procedure. Such fissure filling can improve the visual appearance of an emerald dramatically. This treatment is generally accepted as a necessity due to the fractured nature of emeralds.

Gem labs are determining the presence or absence of any clarity enhancing substance in emeralds, and grade its extent. A broad variety of substances are applied in this treatment, characterised by different optical and mechanical properties, stability and durability. Following the growing request from end consumers for full disclosure, the Gübelin Gem Lab has decided also to offer the determination of

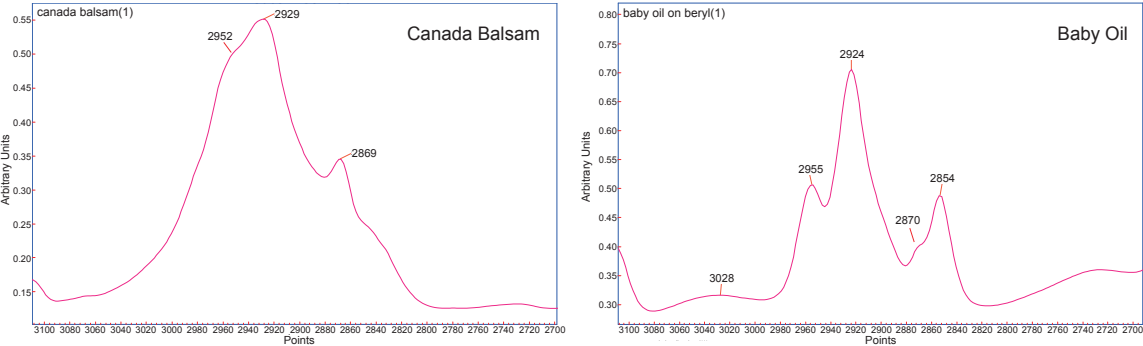
the type of filler materials, distinguishing different types.

The type of filling material is mainly determined by spectroscopic methods, namely FTIR and Raman.

Oil is a traditional type of filler in emeralds, used for more than two thousand years. Mostly of low viscosity it penetrates deep into surface-reaching fissures. Oil can leak or dry out over time, losing its clarity enhancing effect. With the help of cleaning agents such as acetone, the oil can be removed. Hence, oiling is a reversible and repeatable process.

In the definition of the Gübelin Gem Lab, the oil-type group comprises different types of vegetable oils, paraffin oils (such as Johnson’s baby oil), or natural and synthetic Canada balsam and cedar wood oil (tree oils). Most oil-type fillers are liquid to viscous at room temperature.

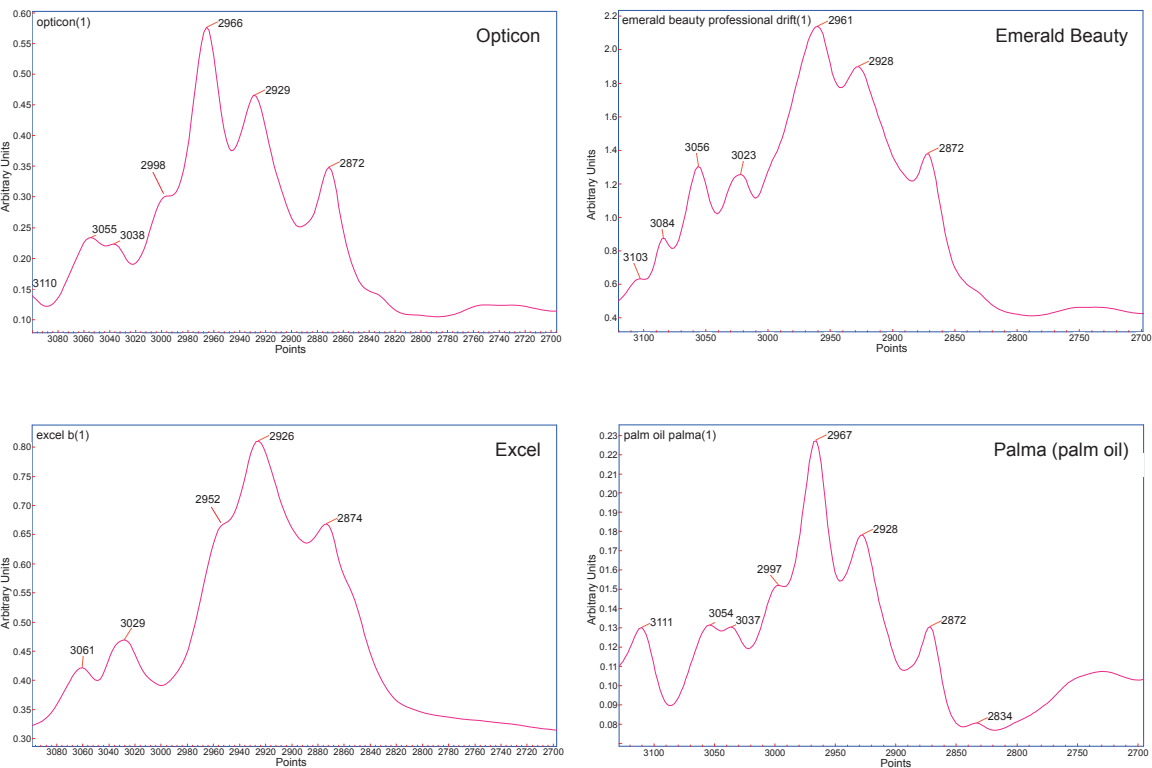
FTIR spectra of oil-type fillers 油質充填物的紅外光譜圖

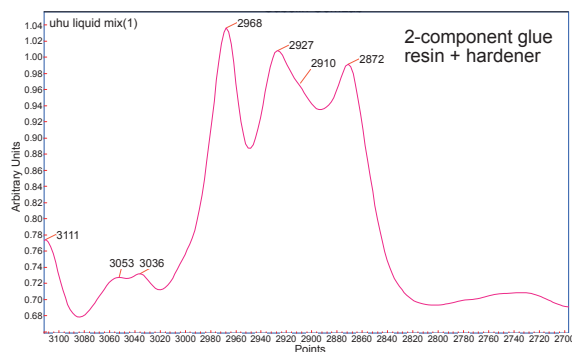
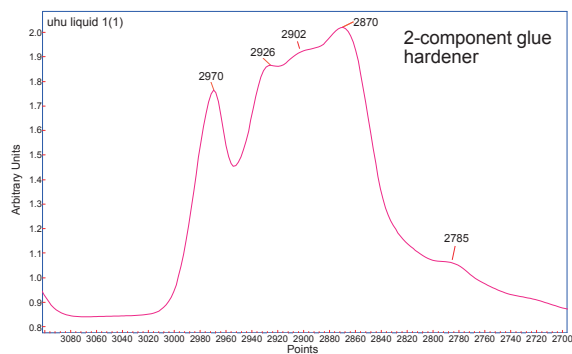
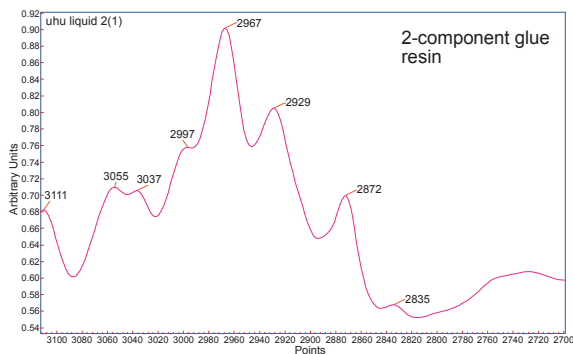


Resins are a more modern type of filling material, used since the middle of the last century. Mostly of synthetic origin, resins comprise several solid or highly viscous substances characterised by optical properties close to those of emerald, and, once applied in fissures, a high viscosity. This property makes resin more durable and stable, and hence suitable not only for clarity enhancement, but also for stabilising lower quality material which would not normally be sufficiently durable for use in jewellery without such treatment. Consequently,

lower grades of emerald are mostly treated with resin. Due to their more stable nature, resins are applied in combination with a polymerising hardening substance. The most common resin types and brands include: Opticon, Palm Resin (aka Palma), PermaSafe, ExCel™, Emerald Beauty, Gematrat. With the respective chemical agents, resins can also be removed from fissures, making clarity enhancement in general a reversible and repeatable process.

FTIR spectra of resin-type fillers 樹脂充填物的紅外光譜圖





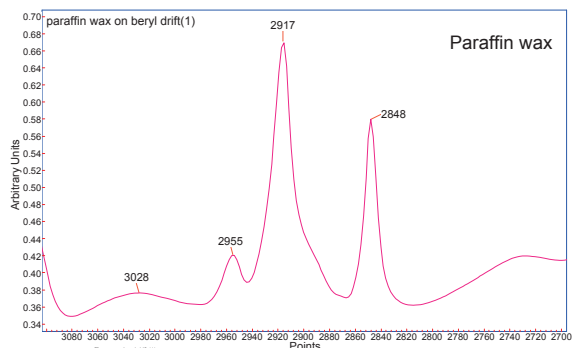
Wax, typically paraffin wax, is another category of filling material used in emeralds. Wax is defined as solid at room temperature, malleable and not soluble in water.

On its gemmological reports, the Gübelin Gem Lab uses - upon request by the client - the following wording for the different types of filling materials:

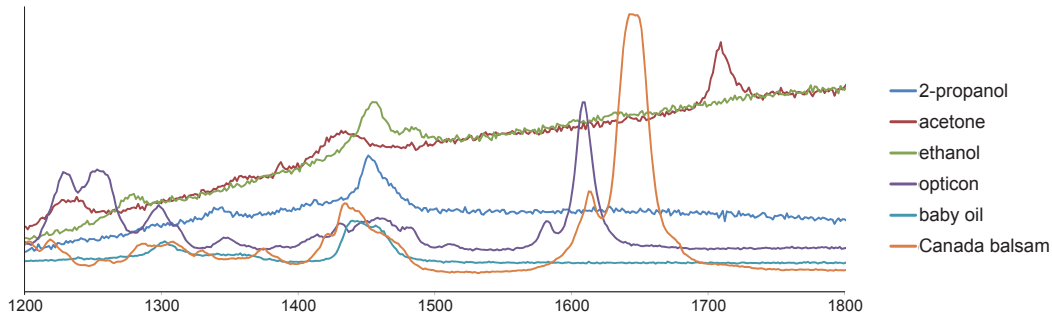
- Traditional (oil-type)
- Modern (resin-type)
- Mixed (oil-type and resin-type)
- Wax

The hardener contained in some type of resins shows the spectroscopic properties of oil. Hence, such resins often cannot be distinguished from an oil-resin-mix.

FTIR spectrum of wax 質充填物的紅外光譜圖



Raman Spectra 拉曼光譜圖



Raman spectra of 3 major cleaning detergents (2-propanol, acetone and ethanol) in comparison with baby oil, Canada balsam and Opticon. Baby oil can be confused with 2-propanol or ethanol, all other substances show diagnostic peaks.

三種主要清潔劑的拉曼光譜圖（2-丙醇、丙酮和乙醇，與BB油、加拿大樹膠和環氧樹脂的比較）。BB油有機會與2-丙醇或乙醇混合，而不同物質均有其獨特的吸收峰。