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RESEARCH ARTICLE

Micro and nanocrystalline ruby skin care products and their applications

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ABSTRACT

A ruby (aluminium oxide with chromium, Al2O3:Cr) is a pink to blood-red colored gemstone, a variety of the mineral corundum(aluminium oxide). The red color is caused mainly by the presence of the element chromium. Rubies are one of the oldest traditional healing stones. Cosmetics created by a jewelry manufacturer contains real diamonds, pearl powder and real ruby powder. It sparkles like jewelry and makes our skin look beautiful. This review attempts to guide the reader between the various micro and nanocrystalline ruby skin care products and their applications, with a particular focus on Giordani Gold Ruby Lipstick. Paper also deals with Scanning Electron Microscope (SEM) images, Transmission Electron Microscope (TEM) images and FTIR spectra of Giordani Gold Ruby Lipstick. This research, along with better regulation and reporting, will enable consumers to choose products with confidence. This in turn will allow companies to benefit from these novel technologies in the long term while retaining customer confidence. Morphological graphs of the Giordani Gold Ruby Lipstick samples are provided by scanning electron microscopy (Digital Scanning Electron Microscope - JSM 6100 - JEOL) with a Link analytical system operating at 15 KV (acceleration voltage) and transmission electron microscope (Transmission Electron Microscope, Hitachi H-7500, 120 kV) Scanning Electron Microscope images of Giordani Gold Ruby Lipstick shows that the material mainly consisted of spherical particles with 1-2 µm in diameter. Although the majority of material consists of micrometer, smaller particles with nanoscale (1-10 nm) are also present in the TEM images. Transmission Electron Microscope images of Giordani Gold Ruby Lipstick shows that the material mainly consisted of spherical particles with 1–10 nm in diameter. Investigations well confirm the presence of Ruby crystals with nanometric size between 1 and 10 nm. FTIR can be routinely used to identify the functional groups and identification/quality control of raw material/finished products. FTIR spectra of Giordani Gold Ruby Lipstick is obtained at room temperature by using an FTIR Spectrophotometer - Perkin Elmer - Spectrum RX-IFTIR. The spectra is collected in a range from 450 to 4000 cm^{-1}. Interpretation of FTIR Spectra of Giordani Gold Ruby Lipstick shows presence of various functional groups such as Alkane – CH_3– C Methyl, CH_3– (C= O), – CH_2– Methylene, CH_2– (C= O), – CH_2– (C ≡ N), $\gtrdot CH$, Ethyl, n-propyl, Iso-propyl, tertiary butyl; Alkene –CH–CH– (Cis); Acids – Carboxylic acids COOH;

Alcohols - Primary alcohols CH_2–OH, Secondary CH–OH, Tertiary C–OH, Aromatic  -OH; Ethers - Aliphatic ethers CH_2–O–CH2; Esters – Formates H–CO–O–R, Acetates –CH_2–CO–O–R, Propionates –CH_2–CO–O–R, Butyrates and up –CH_2–CO–O–R, Acrylates =CH–CO–O–R, Fumarates =CH–CO–O–R, Maleates =CH–CO–O–R, Benzoates, phthalates  -CO–O–R ; Aldehydes - Aliphatic Aldehydes –CH_2–CHO, Aromatic Aldehydes  - CHO; Ketones – Aliph. Ketones CH_2–CO–CH_2; Anhydrides – Normal anhydrides C–CO–O– CO–C, Cyclic anhydrides  ; Aromatic – Monosustituted Benzene  ; Amines – Primary amines CH_2–NH_2, >CH–NH2; Amines (cont) – Secondary amines - CH_2–NH–CH_2, CH–NH–CH,  -NH–R , Hydrochloride C–$NH3^+Cl$, Tertiary amines $(CH_2)_3N$; Imines – Substituted Imines >C=N–C, Imines >C=NH; Amides – Monosubstituted amide –CO–NH–R.

Keywords: Ruby, Giordani Gold Ruby Lipstick, Scanning Electron Microscope (SEM) images, Transmission Electron Microscope (TEM) images, FTIR spectra.

INTRODUCTION

A ruby (aluminium oxide with chromium, Al_2O_3:Cr) is a pink to blood-red colored gemstone, a variety of the mineral corundum(aluminium oxide). The red color is caused mainly by the presence of the element chromium. Rubies are one of the oldest traditional healing stones. Cosmetics created by a jewelry manufacturer contains real diamonds, pearl powder and real ruby powder. It sparkles like jewelry and makes our skin look beautiful.

Figure 1: Natural ruby crystals

This review attempts to guide the reader between the various micro and nanocrystalline ruby skin care products and their applications, with a particular focus on Giordani Gold Ruby Lipstick. Paper also deals with Scanning Electron Microscope (SEM) images, Transmission Electron Microscope (TEM) images and FTIR spectra of Giordani Gold Ruby Lipstick.This research, along with better regulation and reporting, will enable consumers to choose products with confidence. This in turn will allow companies to benefit from these novel technologies in the long term while retaining customer confidence.

1. Cosmetic composition for decorative applications The invention relates to a cosmetic composition, particularly for decorative applications, with a proportional content of a liquid, highly viscous or solid, dermatologically compatible carrier material and a pure powder of precious stones or precious stone mixtures. [1]

2. Cosmetics and makeup method Cosmetics are provided which contains an inorganic powder obtained by grinding an inorganic matter, which contains at least two elements selected from among silicon, aluminum, titanium, oxygen, chromium, iron, calcium, magnesium, zirconium and beryllium and has a crystalline structure and a transparency, and having an average primary grain size of from 3 to 20 micrometers.

The cosmetic was invented which includes an inorganic powder obtained by crushing one or more types of an inorganic substance having a crystalline structure and transparency selected from natural quartz, synthetic quartz, crystal, amethyst, emerald, sapphire, ruby,

garnet and rutile; wherein the number of grains having a primary grain size of 25 micrometers or more was less than 15%, and the average primary grain size was in a grain size distribution range of 5 to 15 micrometers. [2]

3. Mineral Make-up Minerals and crystals exist in a lot of the beauty products. The aesthetic and energetic power of crystals and minerals have been known and used for thousands of years by ancient civilizations like the Egyptians and the Chinese. Ancient Egyptians also used kohl (antimony sulfide or lead sulfide) eyeliner.

Even though mineral based make-up was used thousands of years ago, this type of make-up has been revived in the cosmetic spotlight for several years now and touted as the healthier, lighter way to wear make-up. Many brands of mineral make-up use micronized crystals to help provide coverage by reflecting light. Most mineral make-up foundations today consist of titanium dioxide, bismuth oxchloride and mica.

Rose Quartz – Egyptians believed rose quartz had anti-aging properties.

Ruby powder – Ruby's properties include assistance with weight regulation, courage, enthusiasm and passion.

Mica – The ingredient mica can be found in many crystal healing stones like lepidolite and aventurine. Mica is known to reverse the aging process.

Smithsonite – Healing properties include increasing vitality, relieving stress and anxiety, and boosting the health of veins, the immune system and sinuses.

Tourmaline – This crystal has properties that help with detoxing and balancing mental stress

Ultramarines – (Contains lazurite which is a major component in Lapis Lazuli.) Healing benefits include mental endurance, creativity and provides healing benefits for the throat, thyroid and thymus glands.

Sea Salt – Benefits include cleansing of harmful metal toxins stored in the skin and tissues. Purifies our energy field and remineralizes our skin.

Silica Gel – The use of silica gel is also popular in the hair, beauty and make-up forums to help improve hair growth, skin texture and improve brittle nails. [3]

4. Use of cosmetics against infrared radiation A cosmetic composition for use in protecting the human skin against infrared (IR) radiation includes a first plant extract mixture of Green Coffee Seed Extract, Camellia Sinensis Leaf Extract, Pongamia Pinnata Seed Extract, Angelica Archangelica Root Extract and Citrus Aurantium (Bitter Orange) Peel extract; a second mixture of vitamins E and C and derivatives thereof; a third mixture of particular materials of ruby powder, mica and titanium dioxide, the ruby powder having a particle size of d_{90}<10 µm; and cosmetic auxiliaries. The composition shows a synergistic effect because of a significantly higher degree of protection than the single groups of substances. [4]

5. Giordani Gold Ruby Lipstick by Oriflame
The Ruby has represented royalty for centuries, and with the infused ruby powder, lipstick finds the perfect balance between radiance and shine. Giordani Gold Ruby Lipstick – Gold Dust its ingredients are Ricinus Communis (Castor) Seed Oil, Mica, Diisostearyl Dimer Dilinoleate, Octyldodecanol, Triisodecyl Trimellitate, Ethylhexyl Methoxycinnamate, Polyethylene, Caprylic/ Capric Triglyceride, Copernicia Cerifera Cera, Synthetic Fluorphlogopite, Isopropyl Lanolate, Hydrogenated Vegetable Oil, Pentaerythrityl Tetracaprylate/ Tetracaprate, Calcium Aluminum Borosilicate, Octocrylene, Cera Microcristallina, Paraffin, Candelilla Cera, Tocopheryl Acetate, Alumina, Silica, Persea Gratissima Oil, Ruby Powder, Simmondsia Chinensis Seed Oil, Talc, Propylparaben, Parfum, Retinyl Palmitate, Tin Oxide, BHT, Linalool, Tocopherol, Hydroxycitronellal, Citronellol, Benzyl Benzoate, Citric Acid, CI 77891, CI 77491, CI 17200, CI 15850, CI 77492, CI 77499, CI 19140, CI 16035, CI 45410, CI 42090 [5]

METHODOLOGY

The Electron Microscope is an essential component for scientific analysis of a variety of materials. Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) together comprises a powerful tool in studying (cell and molecular biology, anatomy, microbiology, pathology and forensic science) biological specimens, food stuffs and several other areas of

material sciences (electronics, metallurgy, polymer and surface science).

Morphological graphs of the Giordani Gold Ruby Lipstick sample is provided by scanning electron microscopy (Digital Scanning Electron Microscope - JSM 6100 - JEOL) with a Link analytical system operating at 15 KV (acceleration voltage) and transmission electron microscope (Transmission Electron Microscope, Hitachi H-7500, 120 kV)

Scanning Electron Microscope (SEM) - Digital Scanning Electron Microscope - JSM 6100 (JEOL)

SEM facilitates the observation of very fine details (high resolution) of biological materials and good focus over a wide range of specimen surface (large depth of field). It also produces clear image of specimen ranging from object visible to the naked eye to a structure spanning few nanometers. Besides its use in studying soils, sedimentary particles and rock materials, it also helps to elucidate the architecture and evolution of microfossils.

Digital Scanning Electron Microscope - JSM 6100 (JEOL) is used with a digital image processor. It has a large specimen chamber that allows observation of the entire surface of a specimen upto 150 mm and a tilt of -5 to 90^{o}. A special feature of this SEM is a cryostage attached to it to study the low melting point specimens.

The image processing function permits image averaging and storage, filling of acquired still images and compare-son of two/four images displayed simultaneously on the 12 inch CRT. This function makes it possible to observe specimens without causing damage to them.

Other features of this microscope are:

Resolution	=	4.0 nm at 8mm working distance
Working distance	=	6 to 48 mm
Accelerating Voltage	=	0.3 to 30 KV
Magnification	=	x10 to x300,000
Image Recording	=	on 120 B&W Roll Film (100 ASA) or 35mm B&W roll (25 ASA)
Instant Print	=	an instant print is also possible on a Thermal Video Printer (8x10.5)

Transmission Electron Microscope (TEM) - Hitachi (H-7500) 120 kV

TEM is analogous to the optical microscope. It provides very high resolution which can reach approximately 0.1 nm in the case of lattice images. Consequently very high magnification (Close to 1 million times) can be obtained. TEM is used to examine very thin sections (<60 nm in thickness) through the cells and tissues or through materials as well as replicas of the surfaces of the samples.

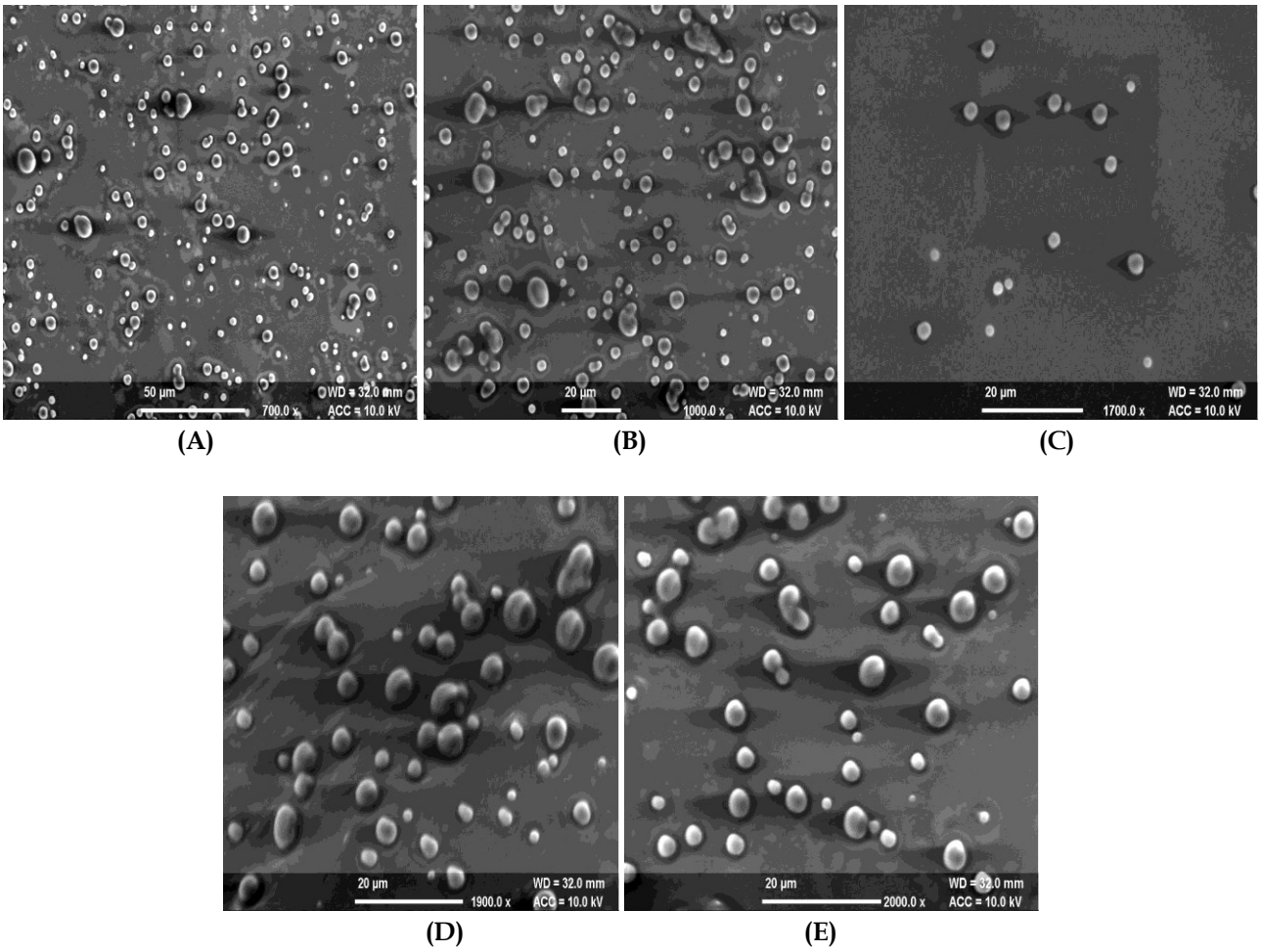
A Transmission Electron Microscope, Hitachi (H-7500) 120 kV is used with CCD Camera This instrument has the resolution of 0.36 nm (point to point) with 40-120 kV operating voltage and can magnify object up to 6 lakh times in High Resolution mode. It has Electron Diffraction, Tungsten Filament, Low Dose Function, High Contrast Mode with ergodynamic look. The specific features of the instrument are: maximum field of views at x700 with dual picture modes, Auto-navigation, Largest possible field with mose contrast, auto pre-irradiation mode (APIS). The equipment has provision for future up-gradation for an analytical system by adding EELS, EDS and STEM attachments.

FTIR Spectrophotometer - Perkin Elmer - Spectrum RX-IFTIR

FTIR can be routinely used to identify the functional groups and identification/quality control of raw material/finished products. Spectrum RX-I offers fast throughput and rapid access to reliable and dependable IR results. High signal to noise ratio makes FTIR more useful for difficult samples. It has resolution of 1 cm^{-1} and scan range of 4000 cm^{-1} to 250 cm^{-1}. In the normal mode around 10 mg sample is required in the form of fine powder. The sample can be analyzed in the form of liquid, solid and thin films also.

FTIR spectra of Giordani Gold Ruby Lipstick is obtained at room temperature by using an FTIR Spectrophotometer - Perkin Elmer - Spectrum RX-IFTIR. The spectra is collected in a range from 450 to 4000 cm^{-1}.

RESULTS AND DISCUSSION

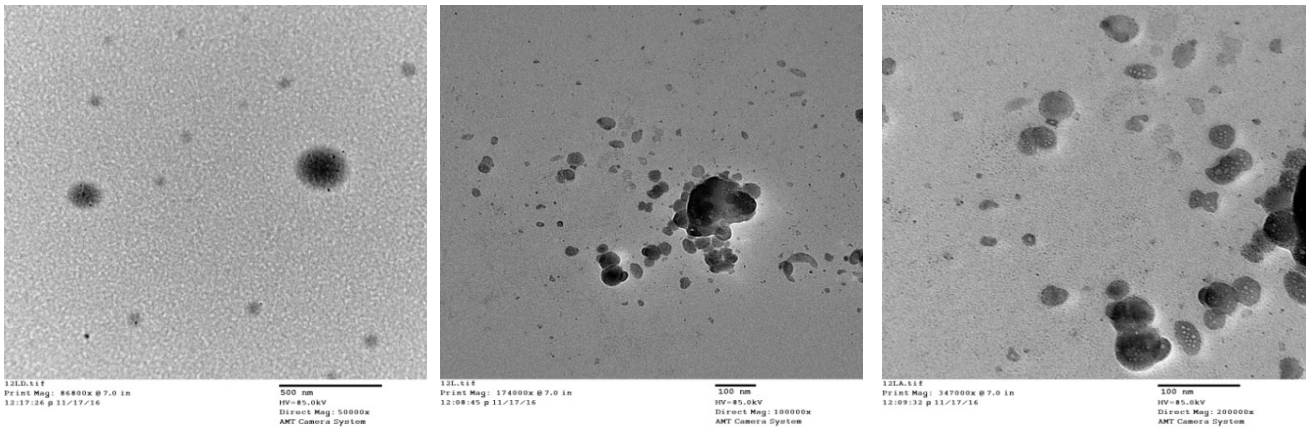


(A) **(B)** **(C)**

(D) **(E)**

Figure 2 (A) – (E) . Scanning Electron Microscope images of Giordani Gold Ruby Lipstick

Figure 2 (A) – (E) shows Scanning Electron Microscope images of Giordani Gold Ruby Lipstick. We can learn from Figure 2 (A) – (E) that the material mainly consisted of spherical particles with 1-2 µm in diameter. Although the majority of material consists of micrometer, smaller particles with nanoscale (1-10 nm) are also present in the TEM images (Fig. 3 I).



(a) (b) (c)

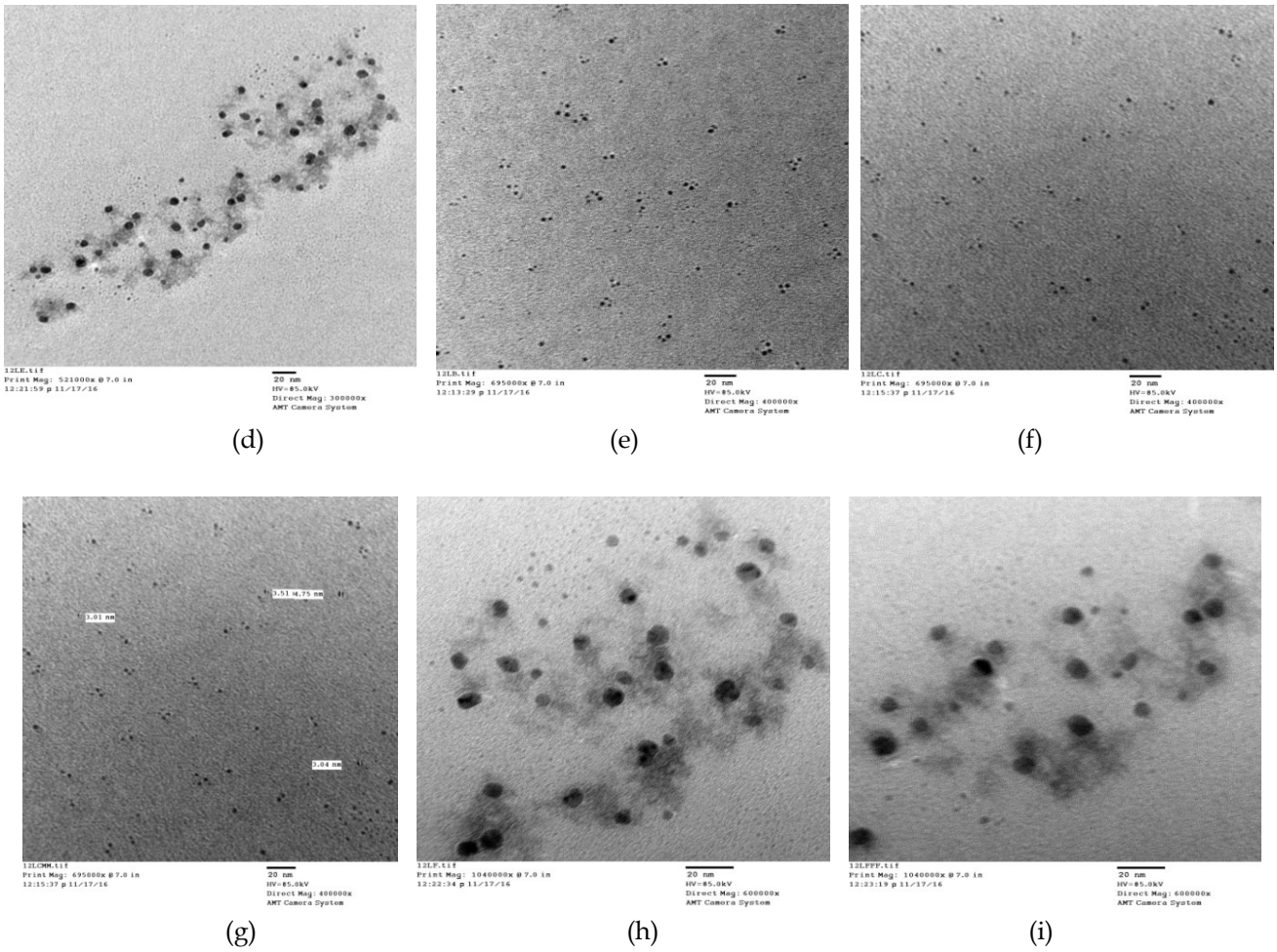


Figure 3 (A) – (I) . Transmission Electron Microscope images of Giordani Gold Ruby Lipstick

Figure 3 (A) – (I) shows Transmission Electron Microscope images of Giordani Gold Ruby Lipstick. These figures shows that the material mainly consisted of spherical particles with 1–10 nm in diameter. Investigations well confirm the presence of Ruby crystals with nanometric size between 1 and 10 nm.

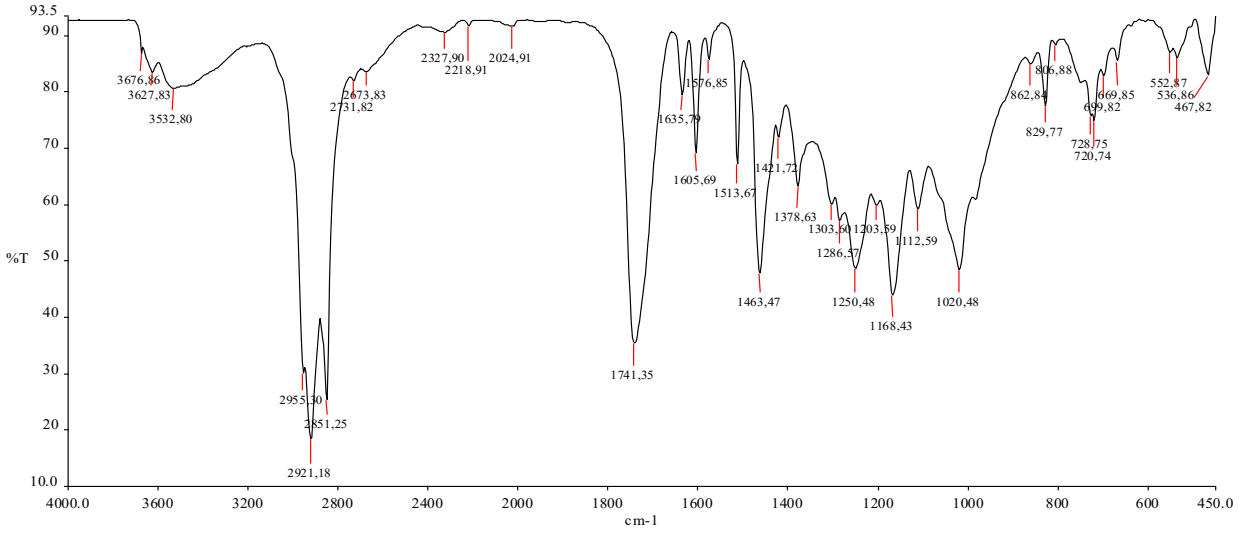
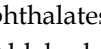


Figure 4. FTIR Spectra of Giordani Gold Ruby Lipstick

Figure 4 shows FTIR Spectra of Giordani Gold Ruby Lipstick. Interpretation of FTIR Spectra of Giordani Gold Ruby Lipstick can be done as follows:

S.N.	Spectral Region Wave number cm^{-1}	Bond causing absorption	Pattern and Intensity of Band
1	3676.86	–	Sharp and Low Intensity
2	3627.83	Alcohols - Secondary CH–OH	Broad and Moderate Intensity
3	3532.80	Alcohols - Secondary CH–OH	Broad and Moderate Intensity
4	2955.30	Alkane – CH_3– C Methyl, CH_3– (C= O), – CH_2– Methylene, CH_2– (C= O), – CH_2– (C ≡ N), $\geqslant CH$, Ethyl, n-propyl	Sharp and Strong Intensity
5	2921.18	Alkane – CH_3– C Methyl, CH_3– (C= O), – CH_2– Methylene, CH_2– (C= O), – CH_2– (C ≡ N), $\geqslant CH$, Ethyl, n-propyl	Sharp and Strong Intensity
6	2851.25	Alkane – CH_3– C Methyl, – CH_2– Methylene	Sharp and Strong Intensity
7	2731.82	–	Broad and Moderate Intensity
8	2673.83	–	Broad and Moderate Intensity
9	2327.90	–	Broad and Low Intensity
10	2218.91	–	Broad and Low Intensity
11	2024.91	–	Broad and Low Intensity
12	1741.35	Esters – Formates H–CO–O–R, Acetates – CH_2–CO–O–R, Propionates –CH_2–CO–O–R, Butyrates and up –CH_2–CO–O–R, Acrylates =CH–CO–O–R, Fumarates =CH–CO–O–R, Maleates =CH–CO–O–R, Benzoates, phthalates  ; Aldehydes - Aliphatic Aldehydes – CH_2–CHO; Ketones – Aliph. Ketones CH_2–CO–CH_2; Anhydrides – Normal anhydrides C–CO–O–CO–C, Cyclic anhydrides 	Sharp and Strong Intensity
13	1635.79	Aromatic – Monosustituted Benzene  ; Amines (Cont) – Hydrochloride C–$NH3^+Cl^-$; Imines – Substituted Imines >C=N–C	Sharp and Moderate Intensity
14	1605.69	Aromatic – Monosustituted Benzene  ; Amines (Cont) – Hydrochloride C–$NH3^+Cl^-$; Imines – Substituted Imines >C=N–C	Sharp and Moderate Intensity
15	1576.85	Amines (cont) – Secondary amines - CH_2–NH–CH_2, CH–NH–CH, , Hydrochloride C–$NH3^+Cl$	Sharp and Low Intensity

16	1513.67	Aromatic – Monosustituted Benzene  ; Amides – Monosubstituted amide –CO–NH–R; Imines – Imines >C=NH	Sharp and Moderate Intensity
17	1463.47	Alkane – CH_3–C Methyl, – CH_2– Methylene, Ethyl, n - propyl,Iso-propyl, tertiary butyl	Sharp and Strong Intensity
18	1421.72	Alkane – CH_3– (C= O); Alkene –CH–CH– (Cis); Aldehydes - Aliphatic Aldehydes – CH_2–CHO, Aromatic Aldehydes 	Sharp and Moderate Intensity
19	1378.63	Alkane – CH_3– C Methyl, Ethyl, n-propyl, Iso – propyl; Alkene –CH–CH– (Cis); Alcohols - Tertiary C–OH, Aromatic  ; Aldehydes - Aliphatic Aldehydes – CH_2CHO, Aromatic Aldehydes 	Sharp and Moderate Intensity
20	1303.60	Alcohols - Secondary CH–OH	Broad and Moderate Intensity
21	1286.57	Alcohols - Secondary CH–OH	Broad and Moderate Intensity
22	1250.48	Acids – Carboxylic acids COOH	Broad and Strong Intensity
23	1203.59	–	Broad and Moderate Intensity
24	1168.43	Ethers - Aliphatic ethers CH_2–O–CH_2; Alcohols - Tertiary C–OH, Aromatic  ; Esters – Formates H–CO–O–R, Propionates –CH_2–CO–O–R, Butyrates and up –CH_2–CO–O–R, Acrylates =CH–CO–O–R, Fumarates =CH–CO–O–R, Maleates =CH–CO–O–R; Anhydrides – Normal anhydrides C–CO–O–CO–C	Sharp and Strong Intensity
25	1112.59	Alkane - Iso – propyl; Aldehydes - Aliphatic Aldehydes – CH_2–CHO; Ketones – Aliph. Ketones CH_2–CO–CH_2; Amines – Primary amines CH_2–NH_2, >CH–NH_2; Amines (cont) – Secondary amines CH_2–NH–CH_2, CH–NH–CH, Tertiary amines $(CH_2)_3N$	Sharp and Moderate Intensity
26	1020.48	Alcohols - Primary alcohols CH_2–OH	Sharp and Strong Intensity
27	862.84	Alkane – Ethyl, n-propyl	Broad and Low Intensity
28	829.77	Alkane - n - propyl	Sharp and Low Intensity
29	806.88	–	Broad and Low Intensity
30	728.75	–	Broad and Low Intensity
31	720.74	–	Broad and Low Intensity

32	699.82	–	Broad and Low Intensity
33	669.85	–	Broad and Low Intensity
34	552.87	–	Broad and Low Intensity
35	536.86	–	Broad and Low Intensity
36	467.82	–	Broad and Low Intensity

Interpretation of FTIR Spectra of Giordani Gold Ruby Lipstick shows presence of various functional groups such as

Alkane – CH_3– C Methyl, CH_3– (C= O), – CH_2– Methylene, CH_2– (C= O), – CH_2– (C ≡ N), $\geqslant CH$, Ethyl, n-propyl, Iso-propyl, tertiary butyl;

Alkene –CH–CH– (Cis);

Acids – Carboxylic acids COOH;

Alcohols - Primary alcohols CH_2–OH, Secondary CH–OH, Tertiary C–OH, Aromatic  -OH;

Ethers - Aliphatic ethers CH_2–O–CH2;

Esters – Formates H–CO–O–R, Acetates –CH_2–CO–O–R, Propionates –CH_2–CO–O–R, Butyrates and up –CH_2–CO–O–R, Acrylates =CH–CO–O–R, Fumarates =CH–CO–O–R, Maleates =CH–CO–O–R, Benzoates, phthalates  -CO-O-R;

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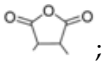
Anhydrides – Normal anhydrides C–CO–O– CO–C, Cyclic anhydrides  ;

Aromatic – Monosustituted Benzene  ;

Amines – Primary amines CH_2–NH_2, >CH–NH2;

Amines (cont) – Secondary amines - CH_2–NH–CH_2, CH–NH–CH,  -NH-R, Hydrochloride C–$NH3^+Cl$, Tertiary amines $(CH_2)_3N$;

Imines – Substituted Imines >C=N–C, Imines >C=NH

Amides – Monosubstituted amide –CO–NH–R

CONCLUSION

Scanning Electron Microscope images of Giordani Gold Ruby Lipstick shows that the material mainly consisted of spherical particles with 1-2 µm in diameter. Although the majority of material consists of micrometer, smaller particles with nanoscale (1-10 nm) are also present in the TEM images.

Transmission Electron Microscope images of Giordani Gold Ruby Lipstick shows that the material mainly consisted of spherical particles with 1–10 nm in diameter.

Investigations well confirm the presence of Ruby crystals with nanometric size between 1 and 10 nm.

FTIR can be routinely used to identify the functional groups and identification/quality control of raw material/finished products.

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Alkene –CH–CH– (Cis);

Acids – Carboxylic acids COOH;

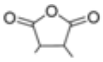
Alcohols - Primary alcohols CH_2–OH, Secondary CH–OH, Tertiary C–OH, Aromatic  -OH;

Ethers - Aliphatic ethers CH_2–O–CH2;

Esters – Formates H–CO–O–R, Acetates –CH_2–CO–O–R, Propionates –CH_2–CO–O–R, Butyrates and up –CH_2–CO–O–R, Acrylates =CH–CO–O–R, Fumarates =CH–CO–O–R, Maleates =CH–CO–O–R, Benzoates, phthalates  -CO-O-R;

Aldehydes - Aliphatic Aldehydes –CH_2–CHO, Aromatic Aldehydes  - CHO;

Ketones – Aliph. Ketones CH_2–CO–CH_2;

Anhydrides – Normal anhydrides C–CO–O– CO–C, Cyclic anhydrides  ;

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Imines – Substituted Imines >C=N–C, Imines >C=NH
Amides – Monosubstituted amide –CO–NH–R

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