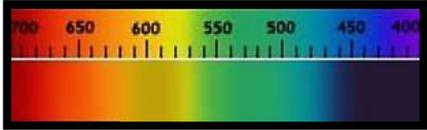


**Warning: this version has been completed with Google Translate , it certainly contains errors or inaccuracies.**

## Technical sheet - general: Spinel

<b>Gemma - names</b>	( Italian - Spinel ) ( English - Spinel ) ( French - Spinelle ) ( Spanish - Espinela ) ( Portuguese - Spinel ) ( Thai - Spinel )		( German - Spinell ) ( Arabic - إسبينيل al'iisbinil ) ( Russian - Шпинель Shpinel ) ( Mandarin - 尖晶石 ji ān jī ng sh í ) ( Swahili - Spinel ) ( Hindi - एक खनिज पदार्थ ek khaniij padaarth )		<p style="text-align: center;"><b>photo</b></p> 	
<b>Colors (GIA)</b>	<p>Some spinel colors are rarer and more valuable than others. In general, the <b>red</b> spinel is most desirable, followed by the subtle <b>cobalt blue spinel</b> , then the vibrant <b>hot pink</b> and from the vivid <b>orange stones</b> . <b>Black</b> , <b>bluish green</b>, <b>Viola</b> and <b>bluish purple</b> , or <b>lavender</b> , stones tend to be less attractive and less in demand than other rarer colors. The shades of blue spinel range from purple blue to slightly greenish blue.</p> <p>Most stones <b>have low saturation</b> and blue hues take on a decidedly grayish appearance. The best and most popular blue spinel colors run parallel <b>to sapphire blue</b> , with intense purple-blue to pure blue colors that are neither too dark nor too light. There are also <b>colorless</b> stones , but they are rare.</p>					
<b>Cause of Color</b>	<p>From <b>purple to purple</b> , Cr<sup>3+</sup> in octahedral coordination and Fe<sup>2+</sup> in tetrahedral coordination. <b>Cobalt blue</b> , Co<sup>2+</sup> and Fe<sup>2+</sup> in tetrahedral coordination. <b>Bluish green</b> Fe<sup>3+</sup> and Fe<sup>2+</sup> in tetrahedral coordination. <b>Green</b> (synthetic spinel), Cr<sup>3+</sup> in octahedral coordination. From <b>pink to red</b> , Cr<sup>3+</sup> in octahedral coordination. Isomorphic replacement of Magnesium by Fe<sup>2+</sup> or Mn, or entirely by Zn.</p>					
<b>Classification</b>	<b>Mineral class</b> Oxides-Hydroxides		<b>Species - Group (mineral)</b> Spinel- Spinels		<b>Variety</b> -	
<b>Optical properties</b>	<b>Specific Gravity:</b> <b>3.50 - 4.10</b> Municipality : 3.578		<b>RI:</b> from 1,712 to 1,736 (1,750 with a high presence of chromium) <b>Polariscope</b> :SR <b>Double refraction:</b> -		<b>Character optical</b> Isotropic	<b>Pleochroism</b> NO
	<b>Luster (luster) - luster of the fracture</b> Vitreo - Vitreo			<b>Dispersion (fire)</b> 0.020		
<b>Light</b>	<b>Fluorescence</b> <b>SWUV</b> : From pink to red: from inert to reddish. Blue: inert. Rare cobalt blue: normally inert. <b>LWUV</b> : From pink to red: inert to red- (orange). Blue: greenish. Rare Cobalt Blue: Faint to moderate red. Colorless and light green: inert to moderate orange-red.			<b>Phosphorescence</b>		
<b>Form</b>	<b>Crystalline dress</b> Octahedral, Dodecahedral (rare) Hexacisohedral <b>Melting point:</b> 1483-2130 ° C		<b>Phenomenal optical effects</b> Asterism (4.6 rays) chatoyancy		<b>Crystalline system</b> Cubic <b>Monometric Crystal class</b>	
<b>Chemical formula</b>	Magnesium aluminum oxide - Magnesium aluminate  <b>MgAl<sub>2</sub>O<sub>4</sub></b>				<b>Spectrometer image</b>  <p style="text-align: center;">Wide absorption band below 490 nm</p>	

<b>Fracture</b>	<b>Flaking</b> NO	<b>Breaking- Parting</b> Very common contact gemination.	<b>Fracture</b> Irregular, chipped, conchoidal
<b>Durability</b>	<b>Hardness (Mohs) - Absolute</b> 8; 200	<b>Toughness</b> Good	<b>Stability</b> (heat, light, chemicals) Excellent
<b>Clarity - characteristics</b>	<b>Typical inclusions:</b> Crystals (calcite, apatite, etc.), octahedral crystals (single or in a fingerprint); two- or three-way silk needles, iridescent cleavage fractures, iron-stained films, negative crystals, stress fracture crystals.		
	<b>Type II</b> Normally included	<b>Transparency (commercial) - transparency</b> Transparent to translucent	
<b>Deposits - types of rocks</b>	<p>Spinel is found as a metamorphic mineral in metamorphosed limestones and silica- poor mudstones. It is also found as a primary mineral in rare mafic igneous rocks; in these igneous rocks, magmas are relatively alkali-deficient compared to aluminum, and aluminum oxide can form like the mineral corundum or can combine with magnesia to form spinel. This is why spinel and ruby are often found together. The petrogenesis of spinel in mafic magmatic rocks is strongly debated, but it certainly derives from the interaction of mafic magma with more evolved magma or rock (eg gabbro, troctolite ). Spinel, <b>( Mg, Fe ) ( Al, Cr )<sub>2</sub>O<sub>4</sub></b>, is common in peridotite in the highest mantle of the Earth, between about 20 km and about 120 km, possibly at shallower depths depending on the chromium content. At significantly shallower depths, above Moho, calcium plagioclase is the most stable aluminous mineral in peridotite while garnet is the deepest stable phase in the mantle below the spinel stability region.</p> <p>Spinel, <b>( Mg, Fe ) A<sub>2</sub>O<sub>4</sub></b>, is a common mineral in Ca-Al-rich inclusions (CAI) in some chondritic meteorites .</p> <p><b>Geological age :</b></p>		
<b>Characteristics of rough stones</b>	Octahedral crystals; very common twinning contact. Triangular incision marks on the octahedral face.		
<b>Main deposits</b>	<b>Afghanistan</b> ( Surobi -Kabul), <b>Cabodia</b> ( Pailin ), <b>China</b> ( Sanming -Fujian, Penglai - Hainan, Nanjing-Jiangsu), <b>Madagascar</b> ( Ilakaka-Ihrombe , Anosy ), <b>Myanmar</b> ( Hpakant -Kachin, Bernarmyo -Mandalay, Katha- Sagaing ) , <b>Pakistan</b> ( Gilgit ), <b>Russia</b> ( Kedrovaya-Primosky River Krai , Aldan- Sakha Republic / Yakuzia ) , <b>Sri Lanka</b> ( Elahera District , Ratnapura, Badulla), <b>Tajikistan</b> ( Pyandzh River Valley , Shakh dara Mountains ) , <b>Tanzania</b> ( Mahenge- Morogoro , Tunduru-Ruvuma ) , <b>Thailand</b> ( Bo Phloi-Kanchanaburi , Bo Rai- Trat ) , <b>USA</b> ( San Luis Obispo -California), <b>Vietnam</b> ( Luc Yn -Yen Bai)		
<b>Year of discovery</b>	<p><b>About 100 BC:</b> The earliest red spinels, used as jewelry, were found in Buddhist tombs in Kabul in Afghanistan and date back to about 100 BC</p> <p><b>1783 :</b> The mineralogist Jean Baptiste Louis Rome de Lisle identifies spinel as a mineral other than ruby.</p>		
<b>History</b>	<p>Spinel gem, which in Italian can be confused with the slang term used to indicate a hand-made cigarette with a paper (sometimes containing drugs), is probably a good candidate for the title of " <b>most underrated gem in history</b> ". Some ancient mines that supplied gems for royal courts from <b>Rome to China</b> produced this stone, but rubies and sapphires were usually confused. The transparent red spinels were called spinel-rubies or balas / balassi / balasci rubies. The term <b>balasso</b> first appeared in historical documents of 14th century Spain, and was owned by a succession of Moorish and Spanish kings before Edward, Prince of Wales, the "black prince", received the stone in <b>1367 as payment . for a victory in battle</b>. In the East, however, its identity was known since ancient times. In ancient Sanskrit writings, spinel was called the " <i>daughter of the ruby</i> ". A beautiful treasure, adored, but distinct.</p> <p>The first red spinels, used as jewelry, were found in Buddhist tombs in Kabul in <b>Afghanistan and date back to around 100 BC</b> . Simultaneously, red specimens also appeared in <b>ancient Roman jewelry</b> (1st century BC). It was the Romans who brought specimens of blue and green spinel to England during their occupation . According to the testimonies</p>		

	<p>of Marco Polo (1254 - 1324 AD), the systematic extraction of these stones began in <b>Afghanistan between 750 and 950 AD.</b></p> <p>After the <b>18th century</b> the word ruby was used only for the red gem variety of the mineral corundum and the word <i>spinel</i> was used . Following this distinction, the demand for these former "oriental rubies" decreased, as did their price, in favor of "royal" rubies. For this reason you won't find many spinels in Georgian antique jewelry. Only in recent years has the gem regained a higher place among precious stones.</p> <p><b>Name :</b> The name "<b>spinel</b>" could be derived from the Greek word "<i>spitha</i>" which means <i>spark</i> or perhaps "<i>spinthir</i>" which means to <i>sparkle</i> . These are just two of the name's many plausible origins, but as faceted spinels are strongly dispersing and typically more sparkling than ruby, one could easily see how its name may have Greek origins. Another theory identifies its etymology with The Latin term <b>spina-spinella</b> , which means <b>small thorn</b> , refers to the sharp points of some crystals.</p> <p>The term "<b>Balas</b>" derives from Balascia , the ancient name of Badakhshan, a region of Central Asia located in the upper valley of the Panj River , one of the main tributaries of the Oxus River. However, "Balascia" itself may be derived from the Sanskrit <i>bālasūryaka</i> , which translates as "crimson morning sun". [14] The mines in the Gorno Badakhshan region of Tajikistan have been the main source of red and pink spinels for centuries.</p>
<p><b>Property attributed</b></p>	<p>This mineral connects <b>with Mother Earth</b> to help provide uplifting vibes of the home planet. Spinel channels the healing powers of nature and the Earth to regenerate life energy and is connected with <b>renewal</b> , overcoming difficult circumstances and <b>rejuvenating the body and mind</b> . It opens the chakras thanks to its wide range of colors and stimulates the <i>kundalini energies</i> to travel along the spine. Spinel is a revitalizing stone and can revitalize all aspects of the person. This makes it an excellent stone <b>for workaholics</b> . It helps <b>relieve stress and anxieties</b> and replenishes <b>low energy levels</b> , similar to what citrine does. This stone <b>brings inspiration</b> . and new hope! The energies of this gem help to find new ways of thinking and give the strength to face life's challenges, making you more tenacious and determined. It slightly improves all the positive sides of one's personality. It also pushes to achieve success with humility and to accept failures with optimism. It also promotes <b>physical vitality</b> and helps relieve all signs of exhaustion of the body, heart, mind and spirit. It pushes towards greater communication and towards mysticism. It also connects the chakras in the physical body with that of the crown chakra, also strengthening intuition and bringing a balance of one's emotions. <b>It livens up creativity</b> and pushes you to overcome fears and insecurities. Joint can provide comfort in the treatment of infertility and with the processes of purification and detoxification. This stone can also calm the nervous system and give good support during a <b>period of recovery from illness or trauma</b> , reducing fatigue and restoring diminished energy levels. Spinel is one of the few gems that can appear in almost any color. This brings them the additional powers of color energy and the ability to influence all Chakra points. Spinel colors include:</p> <ul style="list-style-type: none"> <li>Black - Grounding and protection</li> <li>Blue - Calming and soothing</li> <li>Green - Renewal and Energy</li> <li>Orange - Joy and Creativity</li> <li>Gray - Fresh and balanced</li> <li>Red - Passion and desire</li> </ul> <p>As it comes in so many colors, Spinel is the near-perfect Chakra gem - there is always a spinel that matches the color of any stuck Chakra.</p> <p>It is the <b>22nd wedding anniversary gem</b></p> <p><b>Planet:</b> Saturn, Pluto, Neptune ,</p> <p><b>Month:</b> August (recent addition) <b>Zodiac sign:</b> Leo , Scorpio and Sagittarius</p> <p><b>Chakra:</b> Crown</p>
<p><b>Treatments</b></p>	<p>During most of the history of gemology, heat treatment was thought to have no significant effect on the quality of a spinel. <b>Generally, this is a stone that remains free from human intervention</b> , other than faceting or polishing. However, in 2005 there was talk in the sector of the use of heating to improve the quality of some Tanzanian joints. As a result, research was conducted which showed that heating could indeed be used to alter the quality of some joints. these researchers concluded that this treatment was not done to improve color, as their experiments showed little or no color change or less desirable color resulted from heating. However, they found that <b>the transparency</b> of some spinels could be greatly improved <b>by heating to temperatures between about</b></p>

	<p><b>950 ° C and 1150 ° C.</b> The spinel lattice heated to about 750 ° C goes from what is classified as an ordered structure to a disordered structure.</p> <p>From awareness of the potential for spinel heating, most major laboratories have routinely tested the presented spinel using singly or in combination, photoluminescence and Raman spectroscopy. To date, only a minority of the gems have been determined to be heated in this way. These stones also exhibited features of inclusion that revealed evidence of exposure to heat treatment. More recently, spinel plots inconsistent with the type of spinel heating described have shown various internal characteristics, suggesting a lower temperature intervention. consistent with the type of inclusions reminiscent of rubies, pink sapphires and yellow sapphires. Unexpectedly, the Raman and photoluminescence spectra of these spinels were consistent with an ordered lattice and did not reveal the changes that had so easily distinguished the heated spinels described above. The heat treatment is however stable under normal conditions of use.</p> <p><b>Irradiation</b></p> <p>As a new modification technique, ion beam treatment was applied to enhance the optical appearance and color enhancement of the Burmese red spinel. It has been found that the color appearance of the spinel can be changed by an ion beam giving a result similar to high temperature heat treatment. An ion beam analysis, i.e. PIXE and IL, was the test method applied for the non-destructive characterization of spinel for database creation.</p> <p><b>Filling of fractures</b></p> <p>As with any clear gemstone, spinel can be subjected to fracture filling to improve apparent clarity. This is <b>rarely done to spinel</b> , but if it is, the filling material can alter over time and affect the appearance of the stone. Any fractured stone should only be cleaned with warm soapy water or a damp cloth.</p> <p>Coatings and other less common forms of alteration of the appearance of these gems are possible even if not common .</p>		
<b>Synthetic counterpart</b>	<p><b>Synthetic spinel fusion</b> ( Flame Fusion), separation through: SG 3.61 - 3.65, RI + 1.73, strong ADR chalky effect under short wave, gas bubbles and curved lines under magnification. Synthetic Cobalt Blue Spinel: strong bands centered at 540 nm, 570 nm and 630 nm.</p> <p><b>Synthetic flux spinel</b> (Flux) separation through: flux imprints, metal plates. The synthetic red spinel exhibits a strong purplish to orange-red under the long ultraviolet wave.</p>		
<b>It can be confused with</b>	<p>Natural / synthetic corundum (separation through: optical character, inclusions, pleochroism), Kyanite (separation through: optical character, inclusions), Pyrope garnet (separation through: spectrum, UV fluorescence, inclusions), etc.</p>		
<b>Indicative gemological tests</b>	<p>RI, polariscope analysis, fluorescence, Chelsea filter, microscope.</p>		
<b>Value (2021)</b>	<p><b>High</b> : 5,000-1.0000 \$ / ct <b>3 carat +</b></p>	<p><b>Medium:</b> \$ 1,000-2,000 / ct <b>1-3 carats</b></p>	<p><b>Low:</b> 100-200 \$ / ct <b>below the carat</b></p>
<b>Typical cut</b>	<p>the red spinel could be sold <b>by a third to one-tenth the price of a ruby of equivalent quality</b> , and pink spinel often sells for less than pink sapphire.</p> <p>Oval (6 × 4mm and 7 × 5mm) and cushion cuts are among the most popular, often mixed cuts. Due to the scarcity of spinel on the market, most <b>fine quality</b> blanks are cut to <b>non-standard sizes</b> to save weight, rather than industry standard sizes, which are suitable for center stones in rings.</p>		
<b>Famous stones</b>	<p>One of the most famous spinels in the world is the <b>Black Prince Ruby</b> , the 170-carat gem that adorns the imperial crown of the United Kingdom. And the Timur Ruby, also part of the British crown jewels, is actually a 361-carat shiny red spinel. The Black Prince Ruby is the largest uncut spinel in the world and once decorated King Henry V's helmet during battle. Another great spinel in the Crown Jewels, the "<b>Timur Ruby</b> ", weighs over <b>352 carats</b> . It too has a checkered history. Several Persian inscriptions engraved in the gem testify to its age.</p> <p>Other famous gems include the "<b>Côte de Bretagne</b> ", part of the treasury of the French monarchy.</p>		
<b>Record stones</b>	<p><b>Samaritan</b> spinel is the largest known spinel in the world, weighing 500 carats (100 g).</p>		