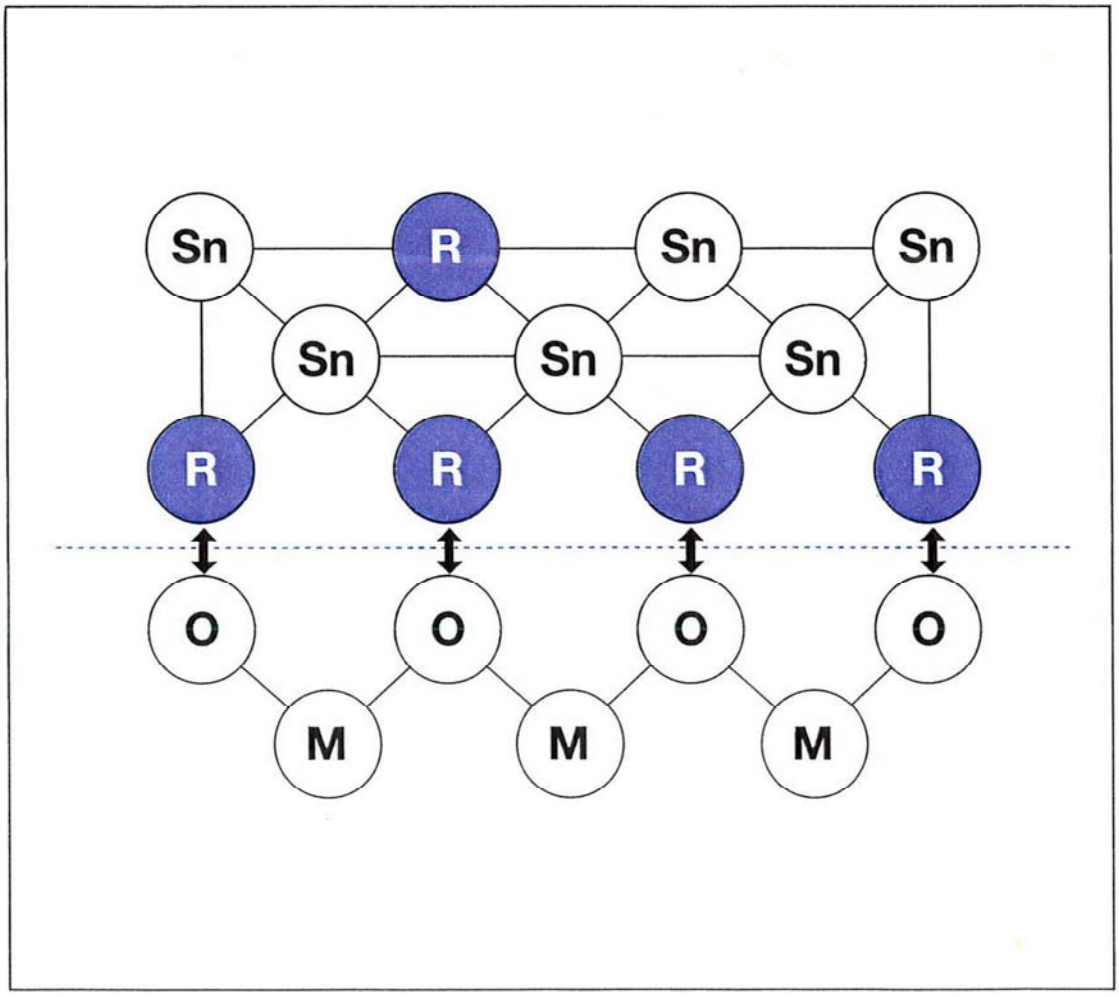
CERASOLZER

TECHNICAL DATA NO.1

Glass Ceramic Metal that Soldering is difficult

Metal Solder

CERASOLZER



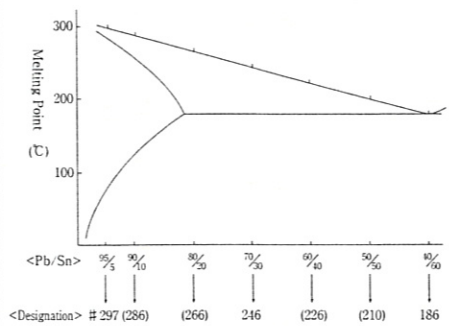
Cerasolzer, a hot product in the industry, is a metal solder directly bondable to glasses and ceramics.

The applications of Cerasolzer are limitless. Cerasolzer has the advantages that cannot be offered by the conventional silver firing, indium soldering, molybdenum-manganese method, deposition, sputtering, etc. and it is a unique material that can significantly contribute to cost reduction and simplified process.

Kuroda Techno has been conducting research and development of not only materials but also technologies and devices required for bonding, which we provide as Cerasolzer technologies. Furthermore, Kuroda Techno has been making continued efforts to develop the peripheral technologies of Cerasolzer, new kinds of Cerasolzer and special solders to increase the range of technologies.

Some Kinds of Microelements Have Been Added to General Pb-Sn Solders.

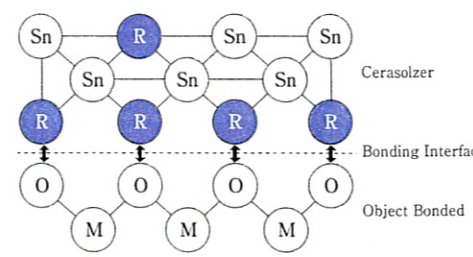
＜Components of Cerasolzer＞



Cerasolzer has almost the same mechanical, electrical and chemical characteristics as general solders. Its most common components are Pb-Sn alloy with Zn, Sb, Al, Ti, Si and Cu added to it. In order to form uniform alloy without segregating those additional elements, they have been melted in a special way. Pb-free Cerasolzer is composed of Sn alloy added with Zn, Sb and Al. Furthermore, we are developing Cerasolzer designed for special applications. Available in different shapes such as wire, bar, thread and ribbon, Cerasolzer can be molded into other special shapes in line with your application.

What makes Cerasolzer bondable?

Glass and Ceramics Are Composed of Metal Oxides. The Additional Elements in Cerasolzer Are Combined with Those Oxides.

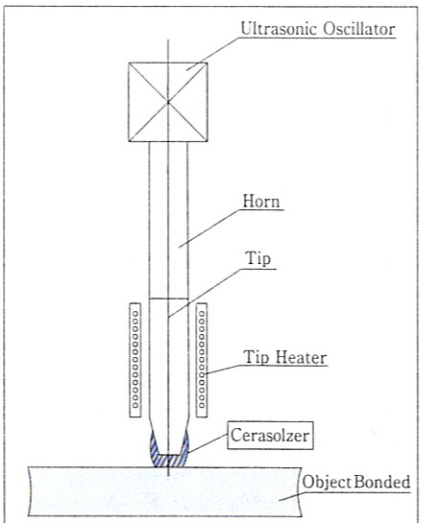


Oxygen is required for bonding. An element (R) has high oxygen affinity and is extremely strongly combined with (O). Generally, (R) is combined with oxygen in the atmosphere to form an oxide (O)-(R), which is combined with (O) or (O)-(M) in the object bonded. That is, they are bonded by chemical combination by way of oxygen.

With No Adhered Organic or Foreign Substances, Bonding Is Done Using Ultrasonic Oscillation Energy and Heat.

<Bonding Cerasolzer>

As Cerasolzer can be directly bonded to an oxide, it requires no activation of the surface as general soldering does. For this reason, it needs no flux used for activation. Intervention of organic substances such as flux tends to have a bad effect on chemical combination, making bonding impossible. Cerasolzer is bonded by chemical combination at the bonding interface. To realize this, chemical combination is required in as broad area as possible on the surface of the object bonded. Therefore, a combination disturbing obstacle must be prevented from intervening the bonding interface. Harmful factors include air layers (air bubbles), organic substances, foreign substances, and so on. Of them, the organic and foreign substances may be eliminated beforehand, but the air layer is not easy to eliminate as it is known. The most effective means to eliminate the air layers is "ultrasonic oscillations," which is capable of eliminating them at the interface in an extremely short time. In addition, a bonding force is enhanced by ultrasonic oscillation energy. In case of bonding with Cerasolzer, it must be melted on the surface of the object bonded, as with soldering. In short, with no adhered organic or foreign substances, bonding is done using ultrasonic oscillation energy and heat. The



<Principle of Cerasolzer Bonding Method>

ultrasonic oscillation frequency used for bonding is 10 to 100 kHz and output is 10 to 1,000 W.

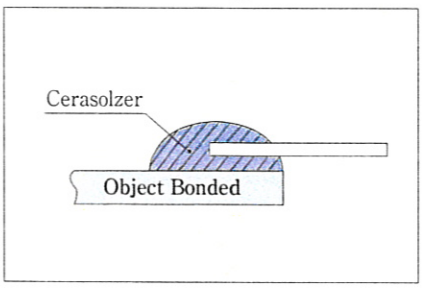
Although you may simply say that Cerasolzer melts on the object bonded, the conditions are actually determined by the heat capacity (heat conduction) of the object bonded, bonding area and melding temperature of Cerasolzer used. In order to melt Cerasolzer on the surface of the object bonded, preheating is generally done. Preheating is required when the heat conductivity of the object bonded is high, when the bonding area is very small, and when the object bonded is damaged by heat gradient. It is preferably recommended to preheat at lower than the melting temperature of Cerasolzer used. Contrary to preheating, it is also conceivable to increase the temperature of the tip, but this is not so desirable from a viewpoint of Cerasolzer's nature.

There Are Three Major Bonding Patterns.

<Bonding Patterns of Cerasolzer>

Cerasolzer has to choose a bonding pattern depending on the function, structure and shape of the object bonded. The bonding pattern may be determined by the performance of Cerasolzer. There are three major bonding patterns of Cerasolzer.

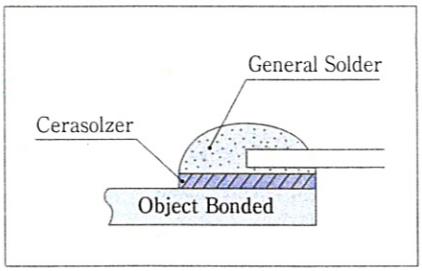
One-Step Bonding



This method is to directly bond a lead wire, metal fitting, etc. to the object bonded with Cerasolzer. In this case, it is necessary to choose the shape of the lead wire, etc. because ultrasonic oscillations are indirectly conveyed to the object bonded.

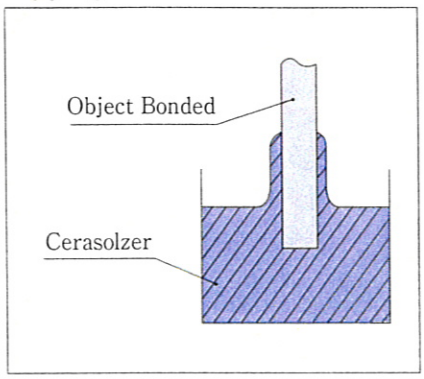
Notes for Bonding Cerasolzer

Two-Step Bonding



This method is to bond Cerasolzer to the object bonded beforehand and use general solder to bond a lead wire, metal fitting, etc. onto it. It hardly affects the shape of the lead wire, etc.

Dipping



This method is to apply ultrasonic oscillations to a bath where Cerasolzer is melted to bond it to all the surface of the object bonded.

Necessary to Approximate Thermal Expansion Coefficients of Two Substances in Case of the Composite Body.

When bonding two types of substances with Cerasolzer, the bonding temperature is 200℃ to 300℃. If there is a difference in their thermal expansion coefficients, they may be distorted, resulting in reduced strength or rupture, when used at the normal temperature. It is ideal to adjust their difference in expansion to within 10 x 10^{-7}/℃. It is also conceivable to take advantage of this phenomenon to intentionally give the difference in expansion.

Cerasolzer Is also a Solder. Watch out for an Eating Phenomenon.

Cerasolzer is a Pb-Sn alloy. In case of two-step bonding, general solder used later is also a Sn-Pb alloy as with Cerasolzer, causing a melting point to drop to their eutectic point (183℃). In order to prevent this, it is necessary to make a layer of Cerasolzer as thick as possible, make the later soldering temperature as low as possible, and minimize a soldering time.

General Cerasolzer Contains Pb, Allowing Easy Oxidation.

General Cerasolzer is an alloy containing much Pb. If it is left in the air in the melted condition, oxidation will progress. Pb-free Cerasolzer is also subject to oxidation. A special element has been naturally added to restrain oxidation. For Cerasolzer "297 to #266, however, oxidation cannot be fully prevented. In reality, it is required to use N_2 gas to restrain oxidation more aggressively. When N_2 gas is used, minimum required O_2 concentration is approx. 1%.

Applicable to a Wide Range of Fields as Well as Glass and Ceramics. Its Applications Are Enormous.

<Applications of Cerasolzer>

Cerasolzer is bondable to not only all the glasses and ceramics, but metals which have been conventionally difficult to solder. Its applications seem limitless because of its applicability to a wide range of fields.

Application to Lead Wire Bonding

The electric or electronic parts always require electric signals to be fed into their active elements and extracted from them. Use of Cerasolzer allows lead wire bonding comparable to conventional silver paste method, resin method and evaporation method. (Various displays, solar batteries, superconductive ceramics, film ICs, resistance capacitor elements, quarts oscillators, and so on)

Application to Airtight Sealing

With extremely high airtightness, Cerasolzer is capable of greatly simplifying conventional complicated processes. (Vacuum tubes, vacuum systems, gas laser, high-voltage resistors, capacitors, and so on)

Application to Bonding of Large Objects such as Furniture and Building Materials

Applicable to bonding of metal fittings to glass plates, and that of furniture and building materials. In this case, Cerasolzer's wonderful strength can be fully exhibited.

Miscellaneous

Also applicable to bonding of electrodes of electronic parts and no-flux soldering.

All Possible Tests Have Been Conducted, Assuming the Requirements and Standards for Marketing as Products/Parts.

<Characteristics of Cerasolzer>

The performance of Cerasolzer as a product/part, bonded to the object bonded by ultrasonic oscillation energy and heat, is very important. The value of Cerasolzer is evaluated only when it satisfies the requirements for temperature, humidity, atmosphere and application where the product/part will be used. In order to satisfy such a variety of requirements, all possible tests have been conducted on Cerasolzer's material to bonding and peripheral technologies to comply with almost all the standards.

Heat Resistance

Heat resistance of Cerasolzer is determined by its melting point. Cerasolzer #297 can endure up to approx. 250℃ in a stress-free state. Other composition types of Cerasolzer can also endure the temperature 30℃ to 50℃ lower than their melting points. If a stress is applied, heat resistance differs depending on the degree of stress. If Cerasolzer is bonded by two-step bonding, it can endure up to approx. 150℃, but it differs depending on the degree of stress. Generally required heat resistance in the low temperature range is -60℃ and Cerasolzer fully satisfies this requirement.

As special applications, it is actually used in liquid nitrogen and liquid helium.

Humidity Resistance

Generally required humidity resistance is 90%RH to 95%RH at 60℃ and Cerasolzer is capable of satisfying this requirement. A special element has been added to Cerasolzer's material in order to enhance humidity resistance. In developing the material, we choose only those showing no abnormality in boiling water.

Cold Cycle

A cold cycle test is conducted to know whether or not the performance of a product/part will deteriorate in the entire temperature range where they will be used. Its temperature difference ranges from 100℃ to 180℃, but Cerasolzer can fully endure a tough condition. It can also endure a more severe cold cycle test combined with a humidity test.

Bonding Strength

Cerasolzer's bonding strength differs depending on its composition. Cerasolzer #297, the typical of all, has the highest bonding strength. Other Cerasolzer has sufficient strength depending on their applications, but the bonding strength is generally reduced as the melting point becomes lower. This is because the bonding strength seems to be affected by the magnitude of residual strain after bonding, depending on the material components. It has been discovered as a very interesting phenomenon that as a post-bonding time passes, Cerasolzer's residual strain tends to be eliminated, increasing its bonding strength.

Other Performance

Cerasolzer has many features and has to be considered in contrast with other technologies which are compared with it. For example, let us compare soldering to a silver baked electrode and two-step bonding. Silver baking has a fatal defect called "silver eating phenomenon," but Cerasolzer is free from it as well as a migration phenomenon.

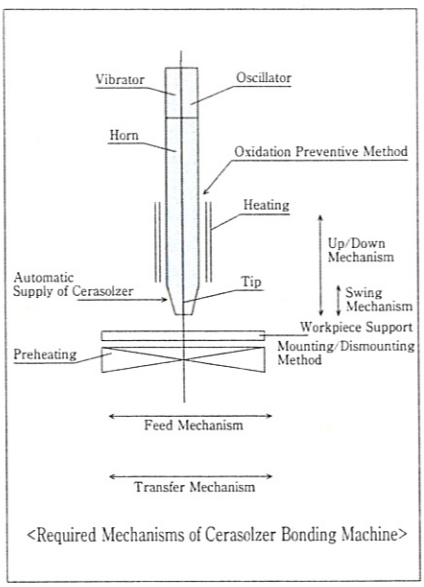
As mentioned above, it is necessary to be fully aware of Cerasolzer' s characteristics to approach. To realize this, you need to be fully familiarized with the part/product used.

Special-Purpose Machine and Novel Technology. It Is Ideal to Progressively Approach Both Hardware and Software.

<Cerasolzer Bonding Machine>

A special-purpose machine is required to bond Cerasolzer. Even the same ultrasonic oscillator leaves something to be desired for Cerasolzer, when its entire oscillation system is reviewed. The ultrasonic oscillation system is the basis of the machine and its peripheral mechanisms play an important role in actually bonding Cerasolzer. A production machine, in particular, requires equipment techniques specific to Cerasolzer. As Cerasolzer technologies are novel ones unable to be found anywhere, it is ideal for the user to progressively approach them. For this purpose, the Cerasolzer bonding machines are largely sorted into two types; so-called experimental ones capable of easily experimenting them to check their performance and production machines capable of actual production.

The machines beyond the specifications of general-purpose machines will be manufactured as special-purpose ones.



<Required Mechanisms of Cerasolzer Bonding Machine>

<Peripheral Technology of Cerasolzer>

Completion of Cerasolzer technologies also requires development of its peripheral technologies. Many technologies stemming from Cerasolzer have been developed these days and are being applied to a wider range of fields.

Technological Development in Two-Step Bonding

Soldering technologies in tune with the production speed of Cerasolzer in order to apply general soldering to interim products obtained by using Cerasolzer.

Development of soldering technologies most suitable to Cerasolzer.

Improvement and Development of Various Mechanisms

Development of Soldering Technologies Based on Ultrasonic Oscillations

Development of no-flux soldering technologies, soldering technologies for low-solderability metals, and materials.

Development of New Types of Cerasolzer

High-melting-point Cerasolzer, low-melting-point Cerasolzer, Cerasolzer for Si, Cerasolzer for vacuum tubes.

Miscellaneous

Ultrasonic technologies, machine materials, and so on.

We Will Continue to Develop Overall Know-How Not Simply as "Cerasolzer," But as "Cerasolzer Technologies."

As you know more about Cerasolzer's nature, bonding methods and performance, you will notice uniqueness of the Cerasolzer Technologies. When you include its peripheral systems and know-how such as bonding technologies, instead of simply regarding it as a material, its potential extends limitlessly. After released in the market, its excellent performance has been increasingly highly evaluated in different fields. We are making every possible effort to develop more extensive technologies.