

0.1 wt % based on the weight of the ceramic char and the silicon carbide powder, care must be taken to either limit the addition of sintering aid to less than about 0.1 wt. %, limit the final firing temperature to about 1800° C. or below or add a material which can eliminate the excess free carbon (e.g., a source of oxygen so that the carbon will be eliminated as CO, a source of silicon so that the free carbon will form SiC, etc.). Organopolysiloxanes which produce chars with less than about 0.1 wt. % free carbon based on the weight of the ceramic char and the silicon carbide powder can be mixed with sintering aids and fired to nearly any desired temperature. Generally, the amount of free carbon should be less than about 10 wt. %.

As long as the organopolysiloxane can be converted to a ceramic char with sufficient char yield and the desired silicon and carbon stoichiometry, its structure is not critical. The organopolysiloxane may, for example, contain units selected from the group consisting of $[R_3SiO_{0.5}]$, $[R_2SiO]$, $[RSiO_{1.5}]$, and $[SiO_2]$, where each R is independently selected from the group consisting of hydrogen, alkyl radicals containing 1 to 20 carbon atoms such as methyl, ethyl, propyl, butyl, etc., phenyl radicals, and vinyl radicals. Organopolysiloxanes which contain vinyl groups are often preferred since vinyl groups attached to silicon provide a mechanism whereby the organopolysiloxane can be cured prior to sintering. Preferred organopolysiloxanes contain varying amounts of $[PhSiO_{1.5}]$, $[MeSiO_{1.5}]$, $[Me_2SiO]$, $[Me_3SiO_{0.5}]$, $[MeViSiO]$ and $[Me_2ViSiO_{0.5}]$ units (Me=methyl, Vi=vinyl and Ph=phenyl). Especially preferred organopolysiloxanes are described by the unit formula



where there are 0 to 90 mole percent $[PhSiO_{1.5}]$ units, 0 to 90 mole percent $[MeSiO_{1.5}]$ units, and 0 to 70 mole percent $[Me_2ViSiO_{0.5}]$ units. Organopolysiloxanes useful in this invention may contain other siloxane units in addition to, or in place of, the siloxane units just mentioned. Examples of such siloxane units include $[ViSiO_{1.5}]$, $[PhMeSiO]$, $[MeHSiO]$, $[PhViSiO]$, $[Ph_2SiO]$, and the like. Mixtures of organopolysiloxanes may also be employed.

The organopolysiloxanes of this invention can be prepared by techniques well known in the art. The actual method used to prepare the organopolysiloxanes is not critical. Most commonly, the organopolysiloxanes are prepared by the hydrolysis of organochlorosilanes or organoalkoxysilane. Such methods, as well as others, are described in Noll, *Chemistry and Technology of Silicones*, chapter 5 (translated 2d Ger. Ed., Academic Press, 1968). Specific methods for preparation of suitable organopolysiloxanes are also illustrated in the examples included in the present specification.

Generally, the amount of organopolysiloxane used in the present invention will depend on factors such as the method of molding, the desired porosity and the desired green strength. Amounts of between about 0.1 and about 50 wt. percent based on the weight of silicon carbide powder are usually used. Preferred amounts are usually in the range of between about 10 and about 30 wt. percent.

Other components in the mixtures of this invention include silicon carbide powder and, optionally, an organopolysiloxane curing agent and/or a sintering aid. The silicon carbide powders useful in this invention are well known in the art and commercially available. Both

alpha-SiC and beta-SiC powders, as well as mixtures, can be used. Generally, powder sizes less than about 10 microns are used. Preferred powder size is in the range of about 0.1 to about 5 microns.

The mixtures used in the process of this invention may, optionally, also contain organopolysiloxane curing agents. Such curing agents can be used to cure (crosslink) the shaped articles prior to sintering. Such cured articles generally have higher green strengths than the uncured articles and, thus, can better withstand any handling or machining processes prior to sintering. Conventional organopolysiloxane curing agents useful in the present invention are well known in the art. Examples include heat (e.g., 50°-300° C.) activated crosslinking initiators such as organic peroxides, e.g., dibenzoyl peroxide, bis-p-chlorobenzol peroxide, bis-2,4-dichlorobenzol peroxide, di-t-butyl peroxide, dicumyl peroxide, t-butyl perbenzoate, and t-butyl peracetate; and platinum-containing curing agents such as platinum, H_2PtCl_6 , and $((C_4H_9)_3)_2PtCl_2$.

Various room temperature curing agents may also be used. For instance, polyfunctional organosilicon compounds such as Si-H functional silanes, silazanes or siloxanes will function effectively herein.

Preferred organopolysiloxane curing agents include dicumyl peroxide, t-butyl perbenzoate and polyfunctional organosilicon crosslinking agents with Si-H functional groups. Other conventional organopolysiloxane curing agents known in the art may also be used.

The organopolysiloxane curing agent, if used, is present in an effective amount, i.e. an amount sufficient to induce crosslinking in the organopolysiloxane. Therefore, the actual amount of the curing agent will depend on the activity of the actual agent used. Normally, however, the non-platinum curing agent will be present at about 0.1 to 5.0 weight percent based on the weight of the organopolysiloxane with the preferred level being about 2.0 weight percent. When the organopolysiloxane or organopolysiloxanes contain both vinyl groups and hydrogen atoms attached to silicon, platinum-containing curing agents can be used. For such platinum-containing curing agents, the level of curing agents will normally be such that platinum is present at about 1 to 1000 ppm based on the weight of the organopolysiloxane with the preferred level at about 50 to 150 ppm platinum. Polyfunctional organosilicon compounds are generally used in an amount of between about 0.1 and about 5 wt. % based on the weight of the organopolysiloxane.

Other additives may also be used in the mixture of the present invention. For instance, processing aids such as lubricants, deflocculants and dispersants may be used herein. Examples of these materials include stearic acid, mineral oil, paraffin, calcium stearate, aluminum stearate, succinic acid, succinimide, succinic anhydride or various commercial products such as Aloa 1200 TM.

Additionally, sintering aids may also be included in this invention, if desired. If such agents are used, however, care must be taken to prevent densification of the ceramic as set forth herein. Suitable metal-containing sintering aids include iron, Fe_3C , magnesium, Mg_3C , lithium, Li_2C_2 , beryllium, Be_2C , boron, boron-containing compounds, aluminum, aluminum-containing compounds, and metal oxides such as thorium oxide, yttrium oxide, lanthanum oxide, and cerium oxide. Many of these metal-containing sintering aids are described in Negita, "Effective Sintering Aids for Silicon Carbide