Common Types of Claybodies

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Earthenware Claybodies often contain relatively high amounts of naturally occurring or added fluxes in order to give good sintered strength at lowfire temperature. As is the case with naturally occurring earthenware clays, true earthenware bodies cannot vitrify and cannot be fired to midrange or highfire temperatures without deforming and bloating. The classic terracotta earthenware bodies are red-brown or red-buff and contain iron rich surface clays and ball clay, plus sand or grog if desired for texture and/or working structure. For sculptural work, additions of fireclay and stoneware clay increase refractoriness and thus decrease firing defects while also improving working structure.

The term earthenware most often brings to mind terracotta, but lighter-fired earthenware clay has been common for millennia. In contemporary terms, lowfire whiteware bodies generally contain a mix of kaolins, ball clays, light-firing stoneware clays, plus strong fluxes to give a usable product. West Coast ceramic sculptors in the 1960s popularized a simple talc body, containing 50% talc and 50% ball clay. At the time it was celebrated as an innovation, but is remarkably similar to clay/talc bodies used by ancient Egyptians 5000 years ago. The talc body seems counterintuitive with so much ball clay, but is in fact highly versatile and works well for handbuilt, thrown, and slip cast lowfire work. Like clay, talc is a sheet lattice phyllosilicate, and thus interferes with plasticity less than most non-plastic materials. Also, talc is magnesium silicate, and magnesium as a flux promotes thermal shock resistance without sand or grog, increasing firing survival rate for large-scale sculptural work.

Vitreous Claybodies include midrange and highfire porcelain and stoneware bodies that become vitrified with a fully-developed glassy phase. Highfire clay bodies such as porcelain or high-iron stoneware often become quite pyroplastic at maturation to the point where the sintered structure barely holds its shape. An extreme case is translucent porcelain, where the glassy phase is so complete that the body begins turning to glass. It is important to realize that translucency and a greatly-increased risk of warpage are inseparable.

Vitreous claybodies for functional ware are designed for maximum hardness and impermeability, and in order to achieve this the maturing point is pushed to the critical limit where the glassy phase is about to start dissolving the sintered skeleton. Such claybodies must be very evenly supported in the kiln to minimize warpage, and functional stoneware and porcelain bodies have little load-bearing strength at maturing temperature and would never be appropriate for refractory pieces like bricks or kiln furniture.

A midrange or highfire claybody designed for functional work will necessarily have a fairly narrow firing range to ensure adequate vitrification. If fired below that range the ware will be fragile and porous, and above that range will bloat and slump. Unfortunately, some commercial clay manufacturers advertise multi-use clay bodies claiming a firing range as great as cone 6 to 11. For a clay body truly appropriate for utilitarian ware, such a broad firing range is impossible. A clay body that is well vitrified at cone 6 will slump and bloat at cone 10 or 11, and a clay body that vitrifies appropriately at cone 10 or 11 will be porous and underfired at cone 6. For functional ware, choose clay bodies that claim a firing range no greater than four cones, and aim for the upper end of that range.

Porcelains are gritless, vitreous midrange or highfire claybodies containing kaolins, other white firing clays, and non-plastic components. In true porcelain bodies iron content must be minimized, restricting the clay choices to kaolins and low-iron ball clays and/or bentonites. Used alone, pure kaolins are too coarse and refractory. Up to 25% ball clay and/or up to 3% bentonite increases plasticity but can give a slight buff tint in oxidation and a slight grayish tint in reduction. Tennessee #10 ball clay and refined bentonites like Macaloid or Veegum-T are often used for their whiter color. Some porcelain potters have investigated organic plasticizers common in industry, and now used by commercial clay suppliers in some of the most exotic and expensive plastic porcelain bodies. While these bodies perform well for specific applications, there are problems and challenges, and often the dry scraps cannot be slaked down and recycled.

Up to 50% of a combination of feldspar and silica promotes a well-developed glassy phase capable of bonding the refractory kaolins and providing dense vitrification. A popular traditional porcelain body contains equal parts kaolin, ball clay, flint, and potash feldspar.

Strictly speaking, true traditional porcelain bodies never contained more than 50% clay, and it used to be that any white clay body with clay content exceeding 50% was considered to be a porcelaneous stoneware. Today the definitions have been relaxed, and the most popular porcelain throwing bodies often contain more than 50% clay content.

Stoneware Claybodies use natural stoneware clay and/or fireclay as a base, with possible additions of other clays, fluxes, grog and/or sand. Added fireclay and ball clay increase the range of particle sizes to produce a highly plastic body with excellent working properties. Sand or grog improves working structure and decreases drying and firing shrinkage but also gives the expected fired texture. Feldspar is usually added to control maturing temperature and glassy phase.

The popular porcelaneous or white stoneware clay bodies contain significant amounts of kaolin along with the lightest burning stoneware and ball clays in order to fire as white as possible, and in addition to feldspar generally include flint in proportion to the amount of kaolin to ensure a good glassy phase. If grit is desired it’s best to use white silica sand or a kyanite or Molochite grog.

Oxidation and Reduction Claybodies can be any of the previously mentioned types adapted specifically for firing in oxidation or reduction. Reduction firing in a fuel kiln brings out more visual texture in the clay, and many reduction clay bodies contain iron-bearing stoneware clays, fireclays, or grog. A reducing atmosphere introduced as early as cone 012 converts ferric iron to ferrous, which later blooms as visible spots or speckles that show through all but the thickest and/or darkest glazes.

Clean oxidation firing was a challenge historically, but is now easily accessible in inexpensive, readily available electric kilns. Traditionally, the surface of oxidation fired clays tended to be quite plain, and potters would often cover as much as possible of the surface with slip or glaze. With the rising popularity of midrange electric firing, ceramic artists have experimented with iron-bearing clays and the addition of granular manganese or ilmenite to provide greater color and surface variation in the fired clay.

As mentioned above, oxidation clay bodies with significant added iron risk bloating and slumping if fired in reduction.

Refractory Claybodies are those used for bricks and kiln furniture. Standard firebrick is composed almost entirely of fireclay and grog, and for the most demanding conditions under load often contain high percentages of alumina. Iron content is kept to a minimum and no supplemental fluxes are added. With a long soaking at high firing temperatures, even the minimal flux content in fireclay is enough to create a felted mass of mullite crystals, giving strong, stable structural pieces that won’t deform under load during firing. Refractory clay bodies must never contain excess silica that would convert cristobalite in repeated firings, reducing thermal shock resistance and causing early failure.