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A COMPOSITE MOULD INSERT AND MOULD

FIELD OF THE INVENTION

5 This invention relates to composite mould inserts and a
mould comprising one or more such inserts. The invention is
particularly useful for, but not necessarily limited to,
rapid prototyping whereby composite mould inserts are formed
10 from a main insert of metal or alloy which complementarily
engages and provides support to one or more plastics inserts
coated with a thermally conductive material.

BACKGROUND ART

15 Mould inserts are generally machined from steel or
aluminium which is relatively slow and expensive especially
when intricate or complex surfaces, recesses or protrusions
are required. Recently, rapid prototyping technology using
solid freeform fabrication techniques such as
20 Stereolithography or selective laser sintering have been
used to reduce the costs and increase the speed of designing
and manufacturing of injection moulds. One such rapid
prototyping technique is described in US patent 5,641,448
which coats a solid freeform fabricated shell with a
25 conductive material to dissipate heat during moulding.

Unfortunately, although such rapid prototyping
techniques are beneficial for relatively small plastics
 housings and products, the stresses due to contraction
30 during curing of the plastics material may cause deformation
of moulds formed by solid freeform fabrication techniques or
the like.. This problem is minimal when considering
injection moulds for small plastics parts, but when



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considering, for instance, pager, radio or cellphone housings, even these relatively small components can provide stresses that distort moulds manufactured from such rapid prototyping techniques.

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SUMMARY OF THE INVENTION

It is an aim of the invention to overcome or alleviate at least one of the problems associated with injection
10 moulds or mould inserts.

According to one aspect of the invention there is provided a composite mould insert for use in injection moulding, said composite mould insert comprising:

15 a main insert of metal or alloy; and
at least one sub insert complementarily engaging said main insert, said sub insert being a plastics insert coated with a thermally conductive material, wherein said complementary engaging provides support to said sub insert
20 to reduce distortion thereof during moulding.

Suitably, said plastics insert may be formed from solid freeform fabrication.

25 Suitably, said main insert may have at least one aperture therein for providing said complementarily engaging of said sub insert.

30 Preferably, said complementary engaging may provide a transition fit of at least part of said sub insert with said aperture.

Suitably, said aperture may have a shoulder. The sub insert may also have a shoulder for complimentary engaging said shoulder of said aperture.

5 In another form, said aperture and said sub insert may have complementarily engaging tapered portions.

Suitably said conductive material may be copper, nickel or any other suitable metal.

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Preferably, said mould insert may be a cavity or core insert.

15 Preferably, said plastics insert may be Stereolithographically formed.

In another form the plastics insert may be suitably formed by selective laser sintering.

20 According to another aspect of this invention, there is provided an injection mould including a plurality of mould inserts, at least one of which is a composite mould insert comprising:

a main insert of metal or alloy; and

25 at least one sub insert complementarily engaging said main insert, said sub insert being a plastics insert coated with a thermally conductive material, wherein said complimentary engaging provides support to said sub insert to reduce distortion thereof during moulding.

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Suitably, said plastics insert may be formed from solid freeform fabrication.

Suitably, said main insert may have at least one aperture therein for providing said complementarily engaging of said sub insert.

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Preferably, said complimentary engaging may provide a transition fit of at least part of said sub insert with said aperture.

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Suitably, said aperture may have a shoulder. The sub insert may also have a shoulder for complimentary engaging said shoulder of said aperture.

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In another form, said aperture and said sub insert may have complementarily engaging tapered portions.

Suitably said conductive material may be copper, nickel or any other suitable metal.

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Preferably, mould may comprise both a cavity and core composite insert.

The mould may also be formed from more than two inserts.

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Preferably, said plastics insert may be Stereolithographically formed.

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In another form the plastics insert may be suitably formed by selective laser sintering.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be readily understood and put into practical effect, reference will now be made to preferred embodiments as illustrated with reference to the accompanying drawings in which:

FIG. 1 is a plan view of a of a first preferred embodiment of a mould base and composite mould insert in accordance with a first embodiment of the invention;

FIG. 2 is a cross sectional view of through A-A of the base and composite mould insert of FIG.1 when incorporated into a two composite insert injection mould;

FIG. 3 is a cross sectional view of an example of a sub insert for use in the composite mould insert of FIG. 1; and

FIG 4 is a cross sectional view of a second preferred embodiment of an injection mould comprising two composite mould inserts in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

With reference to Figs. 1 and 2 there is illustrated an injection mould 1 comprising respective core and cavity composite inserts 2,3 mounted onto recesses of respective mould bases 4,5 as will be apparent to a person skilled in the art. Composite mould insert 2 is a core insert and has

a main insert 6 of a metal or alloy which is typically aluminium. The main insert 6 has two apertures 12,13 that have walls complementarily engaging respective sub inserts 7,8. The shape and size of apertures 12,13 and sub inserts 7,8 are such that they complementarily engage by a transition fit. Further, the walls of the apertures 12,13 and sub inserts 7,8 have respective locating shoulders 15,16 to facilitate correct positioning of the sub inserts 7,8 in the main insert 6.

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Composite mould insert 3 is a cavity insert and has a main insert 9 which again is typically aluminium. The main insert 9 has an aperture 14 with walls complementarily engaging a sub insert 10. The shape and size of aperture 14 and sub inserts 10 is such that they complementarily engage by a transition fit. Further, the walls of the aperture 14 and sub insert 10 have a locating shoulder 17 to facilitate correct positioning of the sub insert in the main insert 9. The composite mould insert 3 and mould base 5 have passages 11 to allow a heated molten plastics material to be injected through these passages 11 and into a mould chamber formed by composite mould inserts 2,3.

In Fig.3 such a typical one of the sub inserts 7,8,10 is illustrated in more detail. As shown, a typical sub insert 20, for complementarily engaging for example main insert 6, comprises a plastics shell 21 coated with a thermally conductive material 22 such as copper, nickel or the like. The coating of the thermally conductive material 22 is achieved for example by electroless plating as described in US patent 5,641,448 and is incorporated into this specification by reference. Further, the shell 21 is typically formed by solid freeform fabrication such as

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Stereolithography, selective laser sintering or the like as will be apparent to a person skilled in the art.

In use, the injection mould 1 is fabricated by the sub
5 inserts 7,8,10 being located by a transition fit into
respective apertures 12,13,14 of main inserts 6,9. Surfaces
of the main inserts 6,9 and sub inserts 7,8,10 form a
composite mould chamber. As will be apparent to a person
skilled in the art, in a mould cycle, the mould bases 4,5
10 move towards each other and therefore the composite mould
inserts 2,3 form the composite mould chamber. A heated
molten plastics material is injected through the passages 11
and into the composite mould chamber formed by composite
mould inserts 2,3. The heated plastics material in the
15 chamber is then allowed to cool and solidify. In this
regard, the aluminium main inserts 6, 9 and coating 22 on
sub inserts 7,8,10 allow for heat dissipation to accelerate
the cooling (curing) of the plastics material. Further, the
transition fit of the sub inserts 7,8,10 in respective
20 apertures 12,13,14 provides support for the sub inserts
7,8,10 to thereby reduce distortion from stresses caused by
the cooling which results in contraction of the plastics
material. Hence, the present invention advantageously
alleviates or reduces the problems associated with mould
25 inserts of plastics materials which can be deformed during
curing.

In addition to the above, the present invention allows
for the main inserts to be used for mould surfaces that are
30 relatively simple or plain and are therefore machined
conventionally. Whereas, the sub inserts are used for mould
surfaces that are relatively intricate or complex and
therefore these mould surfaces can be rapidly and
inexpensively formed.

In Fig. 4, there is illustrated a cross sectional view of a second preferred embodiment of an injection mould 30 which is similar to mould 1 and therefore to avoid repetition only the differences are discussed. As shown
5 mould 30 has composite mould inserts 32,33 mounted onto recesses of respective mould bases 34,35. Composite mould insert 32 is a core insert and has a main insert 36 of aluminium. The main insert 36 has two apertures 42,43 that have walls complimentarily engaging respective sub inserts
10 37,38. The shape and size of apertures 22,43 and sub inserts 37,38 are such that they complimentarily engage by a transition fit. Further, the walls of the apertures 42,43 and sub inserts 37,38 are tapered to facilitate correct positioning of the sub inserts 37,38 in the main insert 36.

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Composite mould insert 33 is a cavity insert and has a main insert 39 of aluminium. The main insert 39 has an aperture 44 with walls complimentarily engaging a sub insert 40. The shape and size of aperture 44 and sub insert
20 40 is such that they complimentarily engage by a transition fit. Further, the walls of the aperture 44 and sub insert 40 are tapered to facilitate correct positioning of the sub insert 40 in the main insert 39. Injection mould 30 is fabricated and used in the same way and has the same
25 advantages as injection mould 1.

Although the invention has been described with reference to preferred embodiments it is to be understood that the invention is not restricted to the particular embodiments
30 described herein. For example, the shoulders 15,16,17 of mould 1 may be of different shapes to that as illustrated and they need not be continuous shoulders. Further, the mould inserts may be solid and need not necessarily be a in the form of a shell.

WE CLAIM:

1. A composite mould insert for use in injection moulding,
said composite mould insert comprising:
 - 5 a main insert of metal or alloy; and
at least one sub insert complementarily engaging said
main insert, said sub insert being a plastics insert coated
with a thermally conductive material, wherein said
complementary engaging provides support to said sub insert
10 to reduce distortion thereof during moulding.
2. A composite mould insert as claimed in claim 1, wherein
said plastics insert is formed from solid freeform
fabrication.
 - 15 Stereolithographically formed.
3. A composite mould insert as claimed in claim 1 or claim
2, wherein said main insert has at least one aperture
20 therein for providing said complementarily engaging of said
sub insert.
4. A composite mould insert as claimed in claim 3, wherein
said complementary engaging provides a transition fit of at
25 least part of said sub insert with said aperture.
5. A composite mould insert as claimed in claim 4, wherein
said aperture has a shoulder.
- 30 6. A composite mould insert as claimed in claim 5, wherein
said sub insert has a shoulder for complementary engaging
said shoulder of said aperture.

7. A composite mould insert as claimed in claim 4, wherein said aperture and said sub insert have complimentarily engaging tapered portions.

5 8. An injection mould including a plurality of mould inserts, at least one of which is a composite mould insert comprising:

a main insert of metal or alloy; and

10 at least one sub insert complimentarily engaging said main insert, said sub insert being a plastics insert coated with a thermally conductive material, wherein said complimentary engaging provides support to said sub insert to reduce distortion thereof during moulding.

15 9. An injection mould as claimed in claim 8, wherein said plastics insert is formed from solid freeform fabrication.

20 10. An injection mould as claimed in claim 8 or claim 9, wherein said main insert has at least one aperture therein for providing said complimentarily engaging of said sub insert.

25 11. An injection mould as claimed in claim 10, wherein said complimentary engaging provides a transition fit of at least part of said sub insert with said aperture.

12. An injection mould as claimed in claim 10, wherein said aperture has a shoulder.

30 13. An injection mould as claimed in claim 12, wherein said sub insert has a shoulder for complimentary engaging said shoulder of said aperture.

14. An injection mould as claimed in claim 10, wherein said aperture and said sub insert have complimentarily engaging tapered portions.

5 15. An injection mould as claimed in claim 9, wherein said plastics insert is Stereolithogaphically formed.

16. A composite mould insert as claimed in claim 2, wherein said plastics insert is Stereolithogaphically formed.

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17. A composite mould insert substantially as described herein with reference to and as illustrated by the accompanying drawings.

15 18. An injection mould substantially as described herein with reference to and as illustrated by the accompanying drawings.