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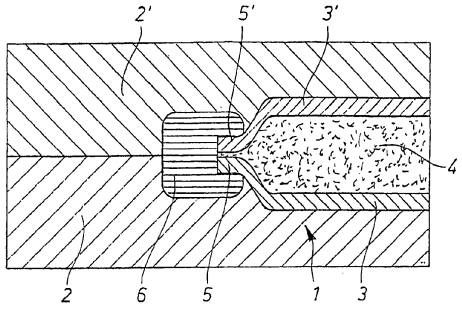
[54] 发明名称

复合构件

[57] 摘要

本发明涉及一种基于夹层结构的复合构件，至少由下列组成：(a)两外层(3，3’)，其各自独立地由各至少一种由金属、塑料、玻璃、天然物质和/或碳制成的膜、板、纤维层和/或泡沫塑料组成，和(b)置于外层(3，3’)之间的芯层，其由含大量空腔的金属、塑料、天然物质和/或纸制成。铸塑树脂体系至少部分贯穿该外层(3，3’)和芯层，并通过压制使外层(3，3’)和芯层(4)相连接。该复合构件的特征在于，该外层(3，3’)在夹层结构的至少一个区(5，5’)相互压制，并且在压制区(5，5’)的该夹层结构由热塑性塑料所包封。



1. 一种基于夹层结构的复合构件，至少由下列组成：

(a) 两个外层(3, 3')，其彼此独立地分别由至少一种金属膜、金属板、塑料膜、塑料板、泡沫塑料、玻璃纤维层、碳纤维层、亚麻纤维层、剑麻纤维层、黄麻纤维层和/或大麻纤维层组成，和

(b) 置于外层(3, 3')之间的芯层（4），其由含大量空腔的金属、塑料、木材、亚麻、剑麻、黄麻、大麻和/或纸制成，

其中，铸塑树脂体系位于芯层和每一外层之间且至少部分贯穿所述外层(3, 3')和芯层(4)，并通过压制使外层(3, 3')和芯层(4)相连接，其特征在于，所述外层(3, 3')在夹层结构的至少一个区域(5, 5',8, 8', 9, 9')中相互压制，并且该夹层结构在压制区域(5, 5',8, 8', 9, 9')中由热塑性塑料（6）包封。

2. 权利要求 1 的复合构件，其特征在于，所述芯层(b)具有波形的、角形的、蜂窝状或泡沫状结构。

3. 权利要求 1 或 2 的复合构件，其特征在于，所述外层(a)是纤维层。

4. 权利要求 1 或 2 的复合构件，其特征在于，所述铸塑树脂体系是双组分聚氨酯体系。

5. 权利要求 1 或 2 的复合构件，其特征在于，在夹层结构的边缘区相互压制所述外层(a)，并用热塑性塑料包封经压制的边缘区。

6. 权利要求 1 或 2 的复合构件，其特征在于，在夹层结构的开口区、卷边区或变形区相互压制所述外层(a)，并用热塑性塑料包封经压制的区。

7. 权利要求 1 或 2 的复合构件，其特征在于，在所述相互压制的外层(a)的区域附近的包封热塑性塑料至少部分充填所述芯层(b)的空腔，使得形成下陷。

8. 权利要求 1 或 2 的复合构件，其特征在于，所述热塑性塑料是基于聚酰胺、聚酯、聚苯乙烯、丙烯腈-丁二烯-苯乙烯、热塑性聚氨酯、聚烯烃、聚碳酸酯、聚环氧丙烷、聚砜、聚苯硫、聚酰亚胺或聚醚醚酮的非增强的、增强的和/或经填充的塑料或这些塑料的混合物。

9. 一种用于制备权利要求 1－8 之一的复合构件的方法，其特征在于下列步骤：

(i) 将芯层和外层置于压制工具中，芯层位于外层之间，

(ii) 在至少一个外层上涂覆铸塑树脂体系，步骤(i)和(ii)可以任意顺序进行，

(iii) 将芯层与外层压制成夹层结构以及在该夹层结构的至少一区域中相互压制外层，

(iv) 使按步骤(iii)所压制的夹层结构脱模，

(v) 将所压制的夹层结构置于注塑工具中，并将热塑性塑料在相互压制的外层的区域中注塑在夹层结构上。

复合构件

本发明涉及一种具有夹层结构的复合构件，其至少由置于两外层之间的芯层组成。铸塑树脂体系至少部分贯穿所述层，并且所述层经压制相互粘合。本发明还涉及制备这种复合构件的方法。

如由 EP 1319503 A 已知一种具有夹层结构的轻质复合构件，其由具有蜂窝结构或波型结构的芯层如纸、铝或塑料和由纤维层如天然纤维、玻璃纤维、塑料纤维或碳纤维制成的下外层和上外层组成。由于其在小壁厚下的低面积重量和高抗弯强度，例如可在汽车制造中用作内贴衬。该下外层和上外层的纤维层例如用双组分聚氨酯(PUR)体系润湿，该体系部分或全部渗入芯层中。该例如可易于发泡的 PUR 体系提供了外层与芯层的成型和粘合。

该夹层复合构件按模压法制造。由芯层和外层制成的该夹层结构的两面表面喷涂以双组分 PUR 体系，并引入到通常加热到 60－160℃，优选 120－140℃的模具中并经压制。脱模和冷却后，该复合构件按需进行如冲压、铣削或包覆。

螺纹连接、局部金属增强、连结部件、紧固部件等的整合的可能性是有限的。例如在压制工具中制备复合构件时，可相应定位插入件，并在压制时通过发泡的和硬化的 PUR 体系与复合构件粘合。该插入件也可完全封入复合构件中，这时将外层如纤维层置于该插入件上面，并在压制时压在插入件上。

另外还已知，将如由塑料制成的模制部件通过熔焊连接在轻质复合构件上。但这是较耗费的，因为首先要单独制备模制部件，然后将其引入熔焊工具中进行熔焊。此外，熔焊连接的质量与所用的材料很有关系。

再则还已知，这类夹层复合构件用易流动的材料如聚氨酯进行包封。该用聚氨酯注塑的复合构件的缺点是有较低的刚度和强度。此外，用交联性的 PUR 树脂体系有针对性地注塑该复合构件的各区域是很耗费的。在注塑的 PUR 中形成毛刺还需要耗费性的后加工。最后，注塑的 PUR 表面对某些应用不能满足光学要求，并不能着色。

本发明的目的在于，在现有技术已知的具有夹层结构的轻质复合

构件基础上提供一种复合构件，其适于借助于注塑法整合功能部件和模制部件，特别是由热塑性塑料制成的模制部件。

本发明主题是一种基于夹层结构的复合构件，其至少由下列组成：

(a) 两外层，其各自独立地分别由至少一种由金属、塑料、玻璃、天然物质和/或碳制成的膜、板、纤维层和/或泡沫塑料组成，和

(b) 置于外层之间的芯层，其由含大量空腔的金属、塑料、天然物质和/或纸制成，

其中，铸塑树脂体系至少部分贯穿外层和芯层，并通过压制使外层和芯层相连接，其特征在于，至少在一部分夹层结构区对外层进行相互压制，并且在压制区的夹层结构用热塑性塑料包封。

本发明的复合构件至少由三层组成：一层芯层和芯层两面的两外层。由多层芯层和由多层外层组成的结构也是可能的。芯层由金属、塑料、天然物质和/或纸构成。优选的金属是铝、镁和它们的合金。优选的塑料是聚酰胺、聚酯、聚碳酸酯、聚丙烯、聚苯乙烯、ABS、聚酰胺-酰亚胺(PAI)和其混合物。塑料可为经增强的或未经强的、经填充的或未经填充的。天然物质的实例是木材、亚麻、剑麻、黄麻、大麻。在本发明中所述的纸意指各类纸，如多层纸，如硬纸板或经树脂浸渍过的纸。

作为主要特征，本发明复合构件的芯层含大量的空腔。该空腔可呈任意几何形状。空腔可以是例如角形的或圆形的通道、孔或气泡。该空腔可呈规则或不规则排列。优选芯层具有波形的、角形的、蜂窝状或海绵类的外型。芯层例如可以是波纹金属板或波纹硬纸板。类似于波纹金属板或波纹硬纸板，芯层也可是角形的而不是波形的，例如具有矩形或三角形形状。此外，类似于波纹金属板或波纹硬纸板，芯层也可由塑料制成。角形或波形的塑料型材例如可是挤压成型的。例如可应用多壁板作为由塑料制成的芯层。

芯层的厚度优选为 5－50 mm。由于大量的空腔，芯层的重量相对于其厚度是小的。其密度优选为 10－1000 kg/m^3。

本发明的复合构件的芯层两面的外层各自独立地由金属、塑料、玻璃、天然物质和/或碳构成。该外层是膜、板、纤维层和/或泡沫塑料。纤维层可以是例如网、织物、针织物、编织物、无纺织物或毡。适于

外层的优选金属是铝、镁和它们的合金。优选的塑料是聚酰胺、聚酯、聚碳酸酯、聚丙烯、聚苯乙烯、ABS、PAI和其混合物。适于外层的天然物质例如是亚麻、剑麻、黄麻和大麻。芯层两面的外层可以是相同的或不同的。

外层厚度优选为0.1－2 mm。该外层的面积重量优选为225－1200 g/m^2。

铸塑树脂体系至少部分贯穿本发明复合构件的面层和芯层。这意味着该铸塑树脂体系部分或全部充填芯层的空腔。如果外层由纤维层或泡沫塑料构成，则该铸塑树脂体系同样也贯穿外层的纤维以及孔、空腔等。如果外层是膜或板，则该铸塑树脂体系存在于外层和芯层之间，并部分或全部润湿外层。该铸塑树脂可用作各层之间的相互连结，这些层在铸塑树脂体系硬化前经热压。在纤维状外层情况下，该铸塑树脂体系同时用于固定纤维以及形成复合构件的表面。通过各层的相互粘结特别是赋予该复合构件以高强度和刚性。至少由芯层、两外层和铸塑树脂体系组成的复合体是现有技术已知的(如 EP 1319503 A)，在本发明中下面也称为夹层结构。

铸塑树脂体系可以是单组分体系或多组分体系如双组分体系。其可以是发泡的或不发泡的。可能的铸塑树脂体系的实例是：聚氨酯（PUR)体系、聚酯树脂体系、环氧树脂体系、丙烯酸树脂体系。优选使用双组分PUR体系，特别优选如EP 1319503 A中第二页第26行到第三页第20行所述的双组分PUR体系。硬化的双组分PUR体系的面积重量优选为400－1200 g/m^2。

现有技术已知的夹层结构的面积重量优选为2100－3600 g/m^2。

按本发明，至少在复合构件的夹层结构的一个区域相互压制所述外层，并在压制区中用热塑性塑料包封该夹层结构。在本发明中该夹层结构的外层的相互压制是指，该夹层结构被压在一起，直到使外层几乎相互接触。处于外层之间的芯层此时被压紧到最小。

外层相互压制可使注塑法中的热塑性塑料在与夹层结构连结。在无相互压制的外层的现有技术已知的夹层结构中出现的问题是，在夹层结构中注塑热塑性塑料时，由于高的注塑压力使塑料不可控地伸展到芯层中，并由此使夹层结构变形或受损。因为按本发明相互压制该外层后该外层几乎相互邻近，所以在注塑时塑料熔体不可再在外层之间

流入芯层。因此该相互压制阻止了塑料熔体在注塑时不可控地渗入芯层并由于处理热塑性塑料所需的高注入压力使芯层变形或受损。外层相互压制也阻止了复合构件的不可控的溢喷，因为该塑料熔体仅可在相互压制的外层区透入注塑工具的空腔。在其余未经压制的区域内，该复合构件邻近工具腔的内壁，由此该工具腔被密封，以防塑料熔体的不可控伸展。

外层例如可在该复合构件夹层结构的边缘区相互压制，并用热塑性塑料包封。这样，可对该夹层结构提供由热塑性塑料部分或连续包封的边缘。但复合构件的外层也可在制备时在任意的其它区相互压制，这取决于在复合构件的哪些区域要用热塑性塑料包封。如果该复合构件具有例如开口，则可压制例如该开口的边缘并用热塑性塑料包封。也可压制复合构件表面中的卷边和其它变形，并用塑料包封。

另一方面也可在复合构件的一个区域中使塑料熔体有针对性地进入芯层中，这可以产生下陷并由此产生夹层结构和热塑性塑料之间的形状合适的连接。这例如可如下实现，即离夹层结构或开口某一距离例如以圆形围绕开孔相互压制该复合构件外层。在注塑时塑料熔体经敞开的即未经压制的该开口的边缘进入芯层。但是，通过压制该塑料熔体可并非是不可控地扩展到芯层中，而仅例如围绕开口最多达经压制的范围。

用注塑法包封该夹层结构的热塑性塑料优选是基于聚酰胺(PA)、聚酯特别是聚对苯二甲酸乙二酯(PET)、聚对苯二甲酸丁二酯(PBT)、聚苯乙烯(PS)、丙烯腈-丁二烯-苯乙烯(ABS)、热塑性聚氨酯(TPU)、聚烯烃特别是聚丙烯(PP)、聚乙烯(PE)、聚碳酸酯(PC)、聚环氧丙烷(PPO)、聚砜(PSO)、聚苯硫(PPS)、聚酰亚胺(PI)、聚醚醚酮(PEEK)的非增强的、增强的和/或经填充的塑料或这些塑料的混合物。

由含铸塑树脂体系的芯层和外层组成的夹层结构以热塑性塑料的包封可提高该夹层结构的刚度和强度。此外，还可以各种方式将功能性部件如增强件、加固件或连接件注塑到夹层结构的任意位置，例如边缘处或表面上。由此可使由其它材料如金属制成的模制部件或构件较简单地与本发明的复合构件相连接。这样就可以较简单的方式使本发明的复合构件整合到由多个相同或不同模制部件或构件组成的整个体系中。也可以这种方式使本发明复合构件类型的多个模型部件相互连

接。

本发明的另一目的在于提供一种制备本发明的复合构件的方法，该方法的特征在于下列步骤:

(i) 将芯层和外层插入压制工具中，将芯层置于外层之间

(ii) 在至少一个外层上涂覆铸塑树脂体系，步骤(i)和(ii)可以任意顺序进行，

(iii) 将芯层与外层压制成夹层结构以及在该夹层结构的至少一区域中相互压制外层，

(iv) 使按步骤(iii)所压制的夹层结构脱模，

(v) 将所压制的夹层结构插于注塑工具中，并将热塑性塑料注塑到相互压制的外层区域中的夹层结构上。

由现有技术已知的本发明的复合构件的夹层结构是借助于模压法制备的，即外层是通过压制，特别是整面的压制与芯层相连接(这里的步骤(iii))。在压制前，铸塑树脂体系以液态特别是整面地涂于至少一外层上(步骤(ii))。该铸塑树脂体系的涂覆可例如通过喷涂进行。该铸塑树脂体系的涂覆(步骤(ii))可在压制工具中在置入外层和芯层(步骤(i))后进行，或在压制工具外在置入外层和芯层前进行。在压制工具中芯层置于外压之间(步骤(i))，并接着进行压制(步骤(iii))。该方法的实施例如描述于 EP 1319503 A 中。

在铸塑树脂体系硬化前，按本发明该夹层结构的外层在所需区域如在边缘区经相互压制(步骤(iii))。压制芯层与外层使该层相互连接以及在所选区域相互压制外层可在压制工具中同时进行或相继进行。外层的相互压制有利地是在与相互压制芯层与外层以制成夹层结构本身的同一压制工具中进行。但原则上也同样可使该两分步骤在不同的压制工具中相继进行。经硬化、需要时冷却和脱模(步骤(iv))后，将经压制的夹层结构置于注塑工具中，并在该注塑工具中在相互压制的外层区域中用热塑性塑料包封该夹层结构(步骤(v))。

本发明的复合构件例如可在汽车制造中用于门衬里部件、车辆底板部件、仪器面板部件、仪器面板支架部件以及卧式车身部件，但也可用于家具或家用设备部件。注塑在经压制的夹层结构上的热塑性塑料可以是功能部件，如加强肋。

下面按附图详述本发明。

图 1 示出在压制的边缘区注塑热塑性塑料后的在注塑工具中的本发明复合构件片段的截面示意图

图 2 示出在压制的边缘区注塑热塑性塑料后的在注塑工具中的本发明复合构件片段的截面示意图，其中该塑料在未经压制区渗入芯层中

图 3 示出在该复合构件的压制开口区域中注塑热塑性塑料后的在注塑工具中的本发明复合构件片段的截面示意图

在图 1 中本发明的复合构件 1 位于注塑工具(未示出)的两半工具 2、2'之间。该复合构件 1 由两外层 3、3'和具有例如蜂窝状结构的芯层 4 构成。芯层 4 位于两外层 3、3'之间。在图 1 中所示的复合构件 1 的实施方案中，外层 3、3'在其边缘区 5、5'处被相互压制，以使外层 3、3'几乎相互紧邻。处于外层 3、3'之间的芯层 4 在经压制的边缘区 5、5'中几乎完全压紧。在经压制的边缘区 5、5'中该复合构件 1 由热塑性塑料 6 所包封。该热塑性塑料 6 不是在相互压制的外层 3、3'之间渗入到该复合构件 1 的芯层 4 中。

不同于图 1 所示的实施方案，在图 2 中示出的实施方案中两外层 3、3'不直接在边缘区 10、10'被相互压制，而是在离边缘 10、10'某些距离的区域 9、9'被相互压制。在未经压制的边缘区 10、10'中向复合构件 1 注塑热塑性塑料 6 时，热塑性塑料 6 渗入芯层 4，即渗入外层 3、3'之间。该热塑性塑料 6 渗入芯层 4 直到经压制的区域 9、9'。这样，该注塑的塑料 6 产生下陷。在经相互压制的外层 3、3'的区域 9、9'中，该塑料 6 不继续渗入芯层 4 中。该压制区 9、9'阻止塑料熔体 6 继续、尤其是不可控地扩展到芯层 4 中。

图 3 示出复合构件 1 的另一实施方案，该构件位于注塑工具(未示出)的两半工具 2、2'之间。外层 3、3'具有相互叠置的开口 7、7'。芯层在叠置的开口 7、7'的区域中也具有开口 11。外层 3、3'在开口 7、7'的周边 8、8'经相互压制。相互叠置的开口 7、7'、11 用热塑性塑料 6 包封，以致该塑料 6 形成与复合构件 1 的形状合适的连接。

在另一未示出的实施方案中，例如还可为包封的热塑性塑料提供开口。

实施例:

夹层结构由厚 6 mm、面积重量约为 1000 g/m^2 的纸质蜂窝结构体

作为芯层和面积重量均约为 400 g/m^2 的两玻璃纤维层作为芯层的两面而构成。所述层用由多元醇和二异氰酸酯(Baypreg F®，Bayer AG，德国)组成的面积重量约为 400 g/m^2 的聚氨酯铸塑树脂体系通过在压制工具中的压制相互连接。如此制成的夹层结构的面积重量为 2630 g/m^2 (密度为 0.4 g/cm^3)。

在压制工具中相互压制各层时，同时即在一个加工步骤中在该聚氨酯铸塑树脂体系硬化前在其外边缘区中相互压制该夹层结构的外层。PUR 树脂硬化后，将该模制件脱模，并将其置于注塑工具中。在该经压制的边缘区于注塑工具中对该夹层结构注塑聚酰胺 6 GF 30。注塑的塑料的厚度为 6 mm。复合构件的总厚度为 6 mm，密度约为 0.7 g/cm^3，面积重量约为 4400 g/m^2。该注塑的热塑性塑料不渗入外层中间的芯层中。

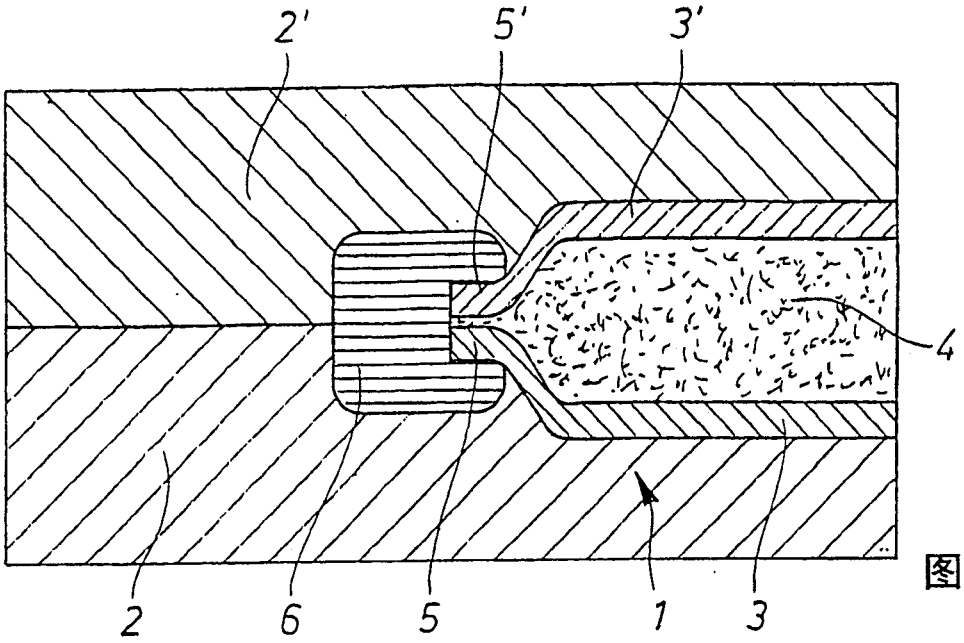


图 1

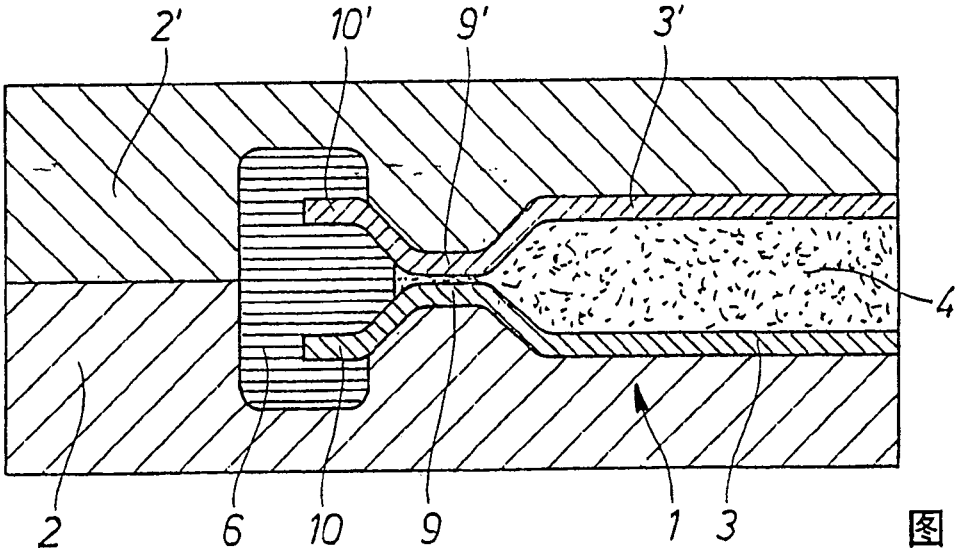


图 2

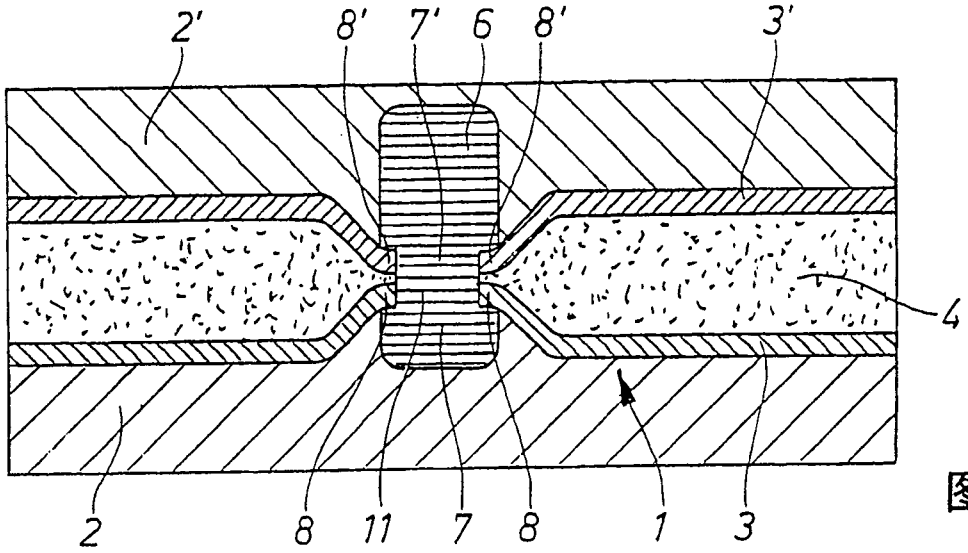


图 3

RESUMO DE102004010810A1 11 A invenção descreve um componente compósito baseado em uma estrutura sanduíche, consistindo pelo menos no DÓLAR A (a) duas camadas de cobertura (3, 3 '), cada uma das quais é feita independentemente de pelo menos um filme, placa, tapete de fibra e / ou espuma de metal, plástico, vidro , Material natural e / ou carbono e DÓLAR A (b) uma camada central (4) feita de metal, plástico, material natural e / ou papel com um grande número de cavidades dispostas entre as camadas de cobertura (3, 3 '), sendo o DÓLAR A um sistema de resina fundida as camadas de cobertura (3, 3 ') e a camada de núcleo penetram pelo menos parcialmente e as camadas de cobertura (3, 3') são conectadas à camada de núcleo (4) pressionando. O componente compósito é caracterizado pelo fato de que as camadas de cobertura (3, 3 ') são pressionadas uma contra a outra pelo menos em uma área (5, 5') da estrutura em sanduíche e a estrutura em sanduíche é revestida por extrusão com material termoplástico (6) na área pressionada (5r, 5 ') é.

CLAIMS CN100486801C

1.

13 A composite component based on a sandwich structure, consisting of at least the following: (a) Two outer layers (3, 3'), which are independently composed of at least one metal film, metal plate, plastic film, plastic plate, foam Plastic, glass fiber layer, carbon fiber layer, flax fiber layer, sisal fiber layer, jute fiber layer and/or hemp fiber layer, and (b) the core layer (4) placed between the outer layers (3, 3')), which is made of metal, plastic, wood, flax, sisal, jute, hemp and/or paper with a large number of cavities, wherein the cast resin system is located between the core layer and each outer layer and at least partially penetrates The outer layer (3, 3') and the core layer (4), and the outer layer (3, 3') and the core layer (4) are connected by pressing, characterized in that the outer layer (3, 3) ') are pressed against each other in at least one area (5, 5', 8, 8', 9, 9') of the sandwich structure, and the sandwich structure is pressed in the pressing area (5, 5', 8, 8', 9, 9 ') is encapsulated by thermoplastic (6).

2.

26 The composite member of claim 1, wherein the core layer (b) has a corrugated, angular, honeycomb or foam structure.

3.

31 The composite component of claim 1 or 2, characterized in that the outer layer (a) is a fiber layer.

4.

35 The composite component of claim 1 or 2, characterized in that the cast resin system is a two-component polyurethane system.

5.

40 The composite component according to claim 1 or 2, characterized in that the outer layers (a) are pressed against each other in the edge area of the sandwich structure, and the pressed edge area is encapsulated with a thermoplastic.

6.

46 The composite component according to claim 1 or 2, characterized in that the outer layer (a) is mutually pressed in the open area, crimping area or deformation area of the sandwich structure, and the compressed area is encapsulated with thermoplastic.

7.

52 The composite component according to claim 1 or 2, characterized in that the encapsulated thermoplastic near the area of the mutually pressed outer layer (a) at least partially fills the cavity of the core layer (b) so as to form a depression.

8.

58 The composite component of claim 1 or 2, wherein the thermoplastic is based on polyamide, polyester, polystyrene, acrylonitrile-butadiene-styrene, thermoplastic polyurethane, polyolefin, polycarbonate, poly Non-reinforced, reinforced and/or filled plastics of propylene oxide, polysulfone, polyphenylene sulfide, polyimide or polyetheretherketone or mixtures of these plastics.

9.

65 A method for preparing a composite component according to any one of claims 1-8, characterized by the following steps: (i) placing the core layer and the outer layer in a pressing tool, the core layer being located between the outer layers, (ii) Coating the casting resin system on at least one outer layer, steps (i) and (ii) can be carried out in any order, (iii) laminating the core layer and the outer layer to form a sandwich structure and mutually in at least one area of the sandwich structure Pressing the outer layer, (iv) demolding the sandwich structure pressed in step (iii), (v) placing the pressed sandwich structure in an injection tool, and injecting the thermoplastic in the area of the mutually pressed outer layer On the sandwich structure.

DESCRIPTION CN100486801C

10 Abstract The present invention relates to a composite component based on a sandwich structure, which is composed of at least the following: (a) Two outer layers (3, 3'), each independently composed of at least one metal, plastic, glass, natural substance and / Or carbon film, board, fiber layer and/or foam plastic composition, and (b) a core layer placed between the outer layers (3, 3'), which is composed of metal, plastic, Made of natural materials and/or paper. The cast resin system at least partially penetrates the outer layer (3, 3') and the core layer, and the outer layer (3, 3') and the core layer (4) are connected by pressing. The composite component is characterized in that the outer layer (3, 3') is pressed

against each other in at least one zone (5, 5') of the sandwich structure, and the sandwich structure in the pressing zone (5, 5') is made of thermoplastic Encapsulation.

19 Composite component

20 The invention relates to a composite component with a sandwich structure, which at least consists of a core layer placed between two outer layers. The cast resin system at least partially penetrates the layers, and the layers are bonded to each other by pressing. The invention also relates to a method of preparing such a composite member.

24 As known from EP 1319503 A, a lightweight composite component with a sandwich structure is composed of a core layer with a honeycomb structure or a corrugated structure such as paper, aluminum or plastic and a fiber layer such as natural fiber, glass fiber, plastic fiber or It is composed of a lower outer layer and an upper outer layer made of carbon fiber. Because of its low area weight and high bending strength under small wall thickness, it can be used as an inner lining in automobile manufacturing, for example. The fiber layers of the lower outer layer and the upper outer layer are, for example, wetted with a two-component polyurethane (PUR) system, which partially or completely penetrates into the core layer. The PUR system, which can be easily foamed, for example, provides the formation and adhesion of the outer layer and the core layer.

32 The sandwich composite component is manufactured according to the molding method. The two-component PUR system is sprayed on both sides of the sandwich structure made of the core layer and the outer layer, and is introduced into a mold usually heated to 60-160°C, preferably 120-140°C, and pressed. After demolding and cooling, the composite component is subjected to stamping, milling or cladding as required.

36 The integration possibilities of threaded connections, local metal reinforcement, connecting parts, fastening parts, etc. are limited. For example, when preparing a composite component in a pressing tool, the insert can

be positioned accordingly and bonded to the composite component through the foamed and hardened PUR system during pressing. The insert can also be completely enclosed in the composite component, in which case an outer layer such as a fiber layer is placed on the insert and pressed on the insert during pressing.

41 It is also known to connect molded parts such as plastics to lightweight composite components by welding. But this is more expensive, because the molded part must first be prepared separately and then introduced into the welding tool for welding. In addition, the quality of the welded connection has a lot to do with the materials used.

45 It is also known that such sandwich composite components are encapsulated with easy-flowing materials such as polyurethane. The disadvantage of this polyurethane injection-molded composite component is its lower stiffness and strength. In addition, it is very costly to inject specific areas of the composite component with a crosslinkable PUR resin system. The formation of burrs in the injected PUR also requires costly postprocessing. Finally, the injection

molded PUR surface cannot meet the optical requirements for some applications and cannot be colored.

51 The object of the present invention is to provide a composite component based on the lightweight composite component with a sandwich structure known in the prior art, which is suitable for integrating functional components and molded components by means of injection molding, especially made of thermoplastic Molded parts.

55 The subject of the present invention is a composite component based on a sandwich structure, which at least consists of the following:

57 (a) Two outer layers, each independently composed of at least one film, board, fiber layer and/or foam plastic made of metal, plastic, glass, natural material and/or carbon, and

59 (b) The core layer placed between the outer layers, which is made of metal, plastic, natural material and/or paper with a large number of cavities,

61 Among them, the cast resin system at least partially penetrates the outer layer and the core layer, and connects the outer layer and the core layer by pressing. It is characterized in that the outer layer is mutually pressed in at least a part of the sandwich structure area, and the sandwich structure in the pressing area Encapsulated with thermoplastic.

65 The composite component of the present invention is composed of at least three layers: a core layer and two outer layers on both sides of the core layer. Structures composed of multiple core layers and multiple outer layers are also possible. The core layer is composed of metal, plastic, natural substances and/or paper. Preferred metals are aluminum, magnesium and their alloys. Preferred plastics are polyamide, polyester, polycarbonate, polypropylene, polystyrene, ABS, polyamide-imide (PAI) and mixtures thereof. The plastic can be reinforced or unstrengthened, filled or unfilled. Examples of natural substances are wood, flax, sisal, jute, hemp. The paper in the present invention means various types of paper, such as multi-layer paper, such as cardboard or paper impregnated with resin.

73 As the main feature, the core layer of the composite member of the present invention contains a large number of cavities. The cavity can have any geometric shape. The cavity may be, for example, angular or circular channels, holes or bubbles. The cavities can be arranged regularly or irregularly. Preferably, the core layer has a corrugated, angular, honeycomb or sponge-like appearance. The core layer can be, for example, corrugated metal sheet or corrugated cardboard. Similar to corrugated metal sheet or corrugated cardboard, the core layer can also be angular instead of corrugated, for example having a rectangular or triangular shape. In addition, similar to corrugated metal sheet or corrugated cardboard, the core layer can also be made of plastic. The

angular or corrugated plastic profile can be extruded, for example. For example, multi-wall panels can be used as the core layer made of plastic.

82 The thickness of the core layer is preferably 5-50 mm. Due to the large number of cavities, the weight of the core layer is small relative to its thickness. Its density is preferably 10-1000kg/m<3>.

84 The outer layers on both sides of the core layer of the composite member of the present invention are each independently composed of metal, plastic, glass, natural material and/or carbon. The outer layer is a film, board, fiber layer and/or foam. The fiber layer may be, for example, a net, fabric, knitted fabric, woven fabric, non-woven fabric, or felt. Preferred metals suitable for the outer layer are aluminum, magnesium and their alloys. Preferred plastics are polyamide, polyester, polycarbonate, polypropylene, polystyrene, ABS, PAI and mixtures thereof. Natural substances suitable for the outer layer are, for example, flax, sisal, jute and hemp. The outer layers on both sides of the core layer can be the same or different.

91 The thickness of the outer layer is preferably 0.1-2 mm. The area weight of the outer layer is preferably 2251200 g/m<2>.

93 The cast resin system at least partially penetrates the face layer and core layer of the composite component of the present invention. This means that the cast resin system partially or completely fills the cavity of the core layer. If the outer layer is composed of a fiber layer or foamed plastic, the cast resin system also penetrates the fibers, pores, and cavities of the outer layer. If the outer layer is a film or a plate, the cast resin system exists between the outer layer and the core layer and wets the outer layer partially or completely. The casting resin can be used as the interconnection between the layers, and these layers are heat-pressed before the casting resin system hardens. In the case of a fibrous outer layer, the cast resin system is used for both fixing the fibers and forming the surface of the composite component. The mutual bonding of the layers gives the composite component high strength and rigidity. A composite body composed of at least a core layer, two outer layers and a cast resin system is known in the prior art (such as EP 1319503 A), and is also referred to as a sandwich structure in the present invention.

104 The casting resin system can be a single-component system or a multi-component system such as a twocomponent system. It can be foamed or unfoamed. Examples of possible casting resin systems are: polyurethane (PUR) systems, polyester resin systems, epoxy resin systems, acrylic resin systems. A twocomponent PUR system is preferably used, and a two-component PUR system as described on the second page, line 26 to the third page, line 20 in EP 1319503 A is particularly preferred. The area weight of the hardened two-component PUR system is preferably 400-1200 g/m<2>.

110 The area weight of the sandwich structure known in the prior art is preferably 2100-3600 g/m<2>.

111 According to the present invention, the outer layers are pressed against each other in at least one area of the sandwich structure of the composite component, and the sandwich structure is encapsulated with thermoplastic in the pressing zone. The mutual pressing of the outer layers of the sandwich structure in the present invention means that the sandwich structure is pressed together until the outer layers are almost in contact with each other. The core layer between the outer layers is now compressed to a minimum.

116 The outer layers are pressed against each other so that the thermoplastic in the injection molding method is connected to the sandwich structure. In the sandwich structures known from the prior art that do not have mutually compressed outer layers, the problem arises that when thermoplastics are injected in the sandwich structure, the high injection pressure causes the plastic to uncontrollably stretch into the core layer and thereby Deform or damage the sandwich structure. Since the outer layers are almost adjacent to each other after they are pressed against each other according to the present invention, the plastic melt can no longer

flow into the core layer between the outer layers during injection molding. This mutual compression therefore prevents the plastic melt from uncontrollably penetrating the core layer during injection molding and deforming or damaging the core layer due to the high injection pressure required to process thermoplastics. The mutual pressing of the outer layers also prevents uncontrollable overflow of the composite component, because the plastic melt can only penetrate into the cavity of the injection molding tool in the area of the mutually pressed outer layers. In the remaining unpressed area, the composite member is adjacent to the inner wall of the tool cavity, whereby the tool cavity is sealed to prevent uncontrollable expansion of the plastic melt.

130 The outer layers can, for example, be pressed against each other in the edge region of the sandwich structure of the composite component and encapsulated with thermoplastic. In this way, the sandwich structure can be provided with edges partially or continuously enclosed by thermoplastic. However, the outer layers of the composite component can also be pressed against each other in any other areas during the preparation, depending on which areas of the composite component are to be encapsulated with thermoplastic. If the composite member has, for example, an opening, the edge of the opening can be pressed, for example, and encapsulated with thermoplastic. It is also possible to suppress curling and other deformations in the surface of the composite component and encapsulate it with plastic.

138 On the other hand, the plastic melt can also be introduced into the core layer in a targeted manner in a region of the composite component, which can result in sagging and thus a suitably shaped connection between the sandwich structure and the thermoplastic. This can be achieved, for example, by pressing the outer layer of the composite component against each other at a certain distance from the sandwich structure or the opening, for example in a circle around the opening. During injection molding, the plastic melt enters the core layer through the edge of the opening that is open, that is, not pressed. However, by pressing the plastic melt may not expand into the core layer uncontrollably, but only surround the opening up to the pressed range, for example.

146 The thermoplastic used to encapsulate the sandwich structure by injection molding is preferably based on polyamide (PA), polyester, especially polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polystyrene Ethylene (PS), acrylonitrile-butadiene-styrene (ABS), thermoplastic polyurethane (TPU), polyolefins, especially polypropylene (PP), polyethylene (PE), polycarbonate (PC), polyepoxy Propane (PPO), polysulfone (PSO), polyphenylene sulfide (PPS), polyimide (PI), polyether ether ketone (PEEK) unreinforced, reinforced and/or filled plastics or these plastics mixture.

152 The encapsulation of a sandwich structure composed of a core layer and an outer layer containing a cast resin system with a thermoplastic can improve the rigidity and strength of the sandwich structure. In addition, functional components such as reinforcements, reinforcements or connectors can be injection molded into any position of the sandwich structure, such as on the edge or on the surface, in various ways. As a result, molded parts or components made of other materials, such as metals, can be connected to the composite component of the present invention more easily. In this way, the composite component of the present invention can be integrated into the entire system composed of multiple identical or different molded parts or components in a relatively simple manner. It is also possible to connect multiple model parts of the composite component type of the present invention in this way.

161 Another object of the present invention is to provide a method for preparing the composite member of the present invention, which is characterized by the following steps:

163 (i) Insert the core layer and the outer layer into the pressing tool, and place the core layer between the outer

layers

165 (ii) Coating a casting resin system on at least one outer layer, steps (i) and (ii) can be performed in any order,

166 (iii) Laminating the core layer and the outer layer to form a sandwich structure and pressing the outer layers against each other in at least one area of the sandwich structure,

168 (iv) demoulding the sandwich structure pressed in step (iii),

169 (v) Insert the pressed sandwich structure into an injection molding tool, and inject the thermoplastic onto the sandwich structure in the outer layer region that is pressed against each other.

171 The sandwich structure of the composite component of the present invention known from the prior art is prepared by means of a molding method, that is, the outer layer is connected to the core layer by pressing, especially the entire surface pressing (here step (iii)). Before pressing, the casting resin system is applied to at least one outer layer in a liquid state, especially the entire surface (step (ii)). The coating of the casting resin system can be carried out, for example, by spraying. The coating of the casting resin system (step (ii)) can be carried out after the outer layer and core layer (step (i)) are placed in the pressing tool, or before the outer layer and core layer are placed outside the pressing tool get on. The core layer is placed between external pressures in the pressing tool (step (i)), and then pressing (step (iii)). The implementation of this method is described in EP 1319503 A, for example.

180 Before the casting resin system hardens, the outer layers of the sandwich structure according to the present invention are mutually pressed in the desired area, such as the edge area (step (iii)). The pressing of the core layer and the outer layer to connect the layers to each

other and the pressing of the outer layers to each other in selected areas can be performed simultaneously or sequentially in the pressing tool. The mutual pressing of the outer layer is advantageously carried out in the same pressing tool as the core layer and the outer layer are mutually pressed to make the sandwich structure itself. In principle, however, the two sub-steps can also be carried out successively in different pressing tools. After hardening, cooling if necessary, and demolding (step (iv)), the compressed sandwich structure is placed in an injection molding tool, and the sandwich is encapsulated with thermoplastic in the mutually compressed outer layer region in the injection molding tool Structure (step (v)).

190 The composite member of the present invention can be used for door lining parts, vehicle floor parts, instrument panel parts, instrument panel bracket parts, and horizontal body parts in automobile manufacturing, but can also be used for furniture or household equipment parts. The thermoplastic injection molded on the pressed sandwich structure can be a functional part, such as a reinforcing rib.

194 The present invention will be described in detail below with reference to the drawings.

195 Figure 1 shows a schematic cross-sectional view of a segment of the composite component of the invention in an injection molding tool after injection molding of thermoplastic in the pressed edge zone

197 Fig. 2 shows a schematic cross-sectional view of a segment of the composite component of the invention in an injection tool after injection of thermoplastic in the pressed edge zone, wherein the plastic penetrates into the core layer in the unpressed zone

200 Figure 3 shows a schematic cross-sectional view of a segment of the composite component of the invention in the injection molding tool after injection of thermoplastic in the area of the pressing opening of the composite component

203 In Figure 1 the composite component 1 of the present invention is located between the two tool halves 2, 2'of an injection molding tool (not shown). The composite member 1 is composed of two outer layers 3, 3'and a core layer 4 having, for example, a honeycomb structure. The core layer 4 is located between the two outer

layers 3, 3'. In the embodiment of the composite member 1 shown in Fig. 1, the outer layers 3, 3'are pressed against each other at their edge regions 5, 5'so that the outer layers 3, 3'are almost adjacent to each other. The core layer 4 located between the outer layers 3, 3'is almost completely compressed in the pressed edge regions 5, 5'. The composite component 1 is encapsulated by a thermoplastic 6 in the pressed edge zone 5, 5'. The thermoplastic 6 does not penetrate into the core layer 4 of the composite member 1 between the outer layers 3, 3'that are pressed against each other.

212 Different from the embodiment shown in FIG. 1, in the embodiment shown in FIG. 2, the two outer layers 3, 3'are not directly pressed against each other in the edge regions 10, 10', but at some distance from the edges 10, 10' Areas 9, 9'of some distance are suppressed each other. When the thermoplastic 6 is injected into the composite component 1 in the unpressed

edge regions 10, 10', the thermoplastic 6 penetrates the core layer 4, that is, between the outer layers 3, 3'. The thermoplastic 6 penetrates into the core layer 4 as far as the pressed areas 9, 9'. In this way, the injection molded plastic 6 sags. In the regions 9, 9'of the outer layers 3, 3'that have been pressed against each other, the plastic 6 does not continue to penetrate into the core layer 4. This pressing zone 9, 9'prevents the plastic melt 6 from continuing to expand into the core layer 4, in particular uncontrollably.

221 Figure 3 shows another embodiment of the composite component 1, which is located between the two tool halves 2, 2'of an injection molding tool (not shown). The outer layers 3, 3'have openings 7, 7'overlapping each other. The core layer also has an opening 11 in the area of the overlapped opening 7, 7'. The outer layers 3, 3'are pressed against each other at the periphery 8, 8'of the openings 7, 7'. The openings 7, 7', 11 that are superimposed on each other are encapsulated with a thermoplastic 6 so that the plastic 6 forms a properly shaped connection with the composite member 1.

227 In another embodiment not shown, for example, openings can also be provided for the encapsulated thermoplastic.

229 Examples:

230 The sandwich structure is composed of a paper pit structure with a thickness of 6mm and an area weight of about 1000g/m<2> as the core layer and two glass fiber layers with an area weight of about 400g/m<2> as the two sides of the core layer. . The layer is made of polyol and diisocyanate (, Bayer AG, Germany) polyurethane casting resin system with an area weight of approximately 400g/m<2> Connect to each other by pressing in the pressing tool. The area weight of the sandwich structure thus produced is 2630 g/m<2> (with a density of 0.4 g/cm<3>).

236 When the layers are pressed against each other in the pressing tool, the outer layers of the sandwich structure are simultaneously pressed against each other in the outer edge region of the polyurethane casting resin system in one processing step before hardening. After the PUR resin hardens, the molded part is demolded and placed in an injection molding tool. Polyamide 6 GF 30 is injected into the sandwich structure in an injection molding tool in the pressed edge area. The thickness of the injection molded plastic is 6 mm. The total thickness of the composite component is 6mm, the density is about 0.7g/cm<3>, and the area weight is about 4400g/m<2>. The injection molded thermoplastic does not penetrate into the core layer in the middle of the outer layer.