Claims

1. A separation fluid (330) for separating multilayer systems containing at least one metal layer and one further layer, the separation fluid (330) comprising a mixture of water, carboxylic acid, carboxylate salt and a passivation agent, wherein the passivation agent is a phosphate, phosphonate, phosphinate salt or a mixture thereof.

2. The separation fluid (330) of claim 1, wherein the carboxylic acid is in any ratio water miscible carboxylic acid and has a pK_a value of between 2.0 and 8.0.

3. The separation fluid (330) of claim 2, wherein the carboxylic acid is selected from the group of C1-C4 fatty acids consisting of formic acid, acetic acid, propionic acid or butyric acid or mixtures thereof.

4. The separation fluid (330) of any one of the above claims, wherein the carboxylate salt is soluble in water (solubility > 10 g carboxylate per 100 g of water at 20 °C) and has a pK_b value between 6.0 and 13.0.

5. The separation fluid (330) of claim 4, wherein the counter cation of the carboxylate salt as well as the passivation agent is a metal cation or a complex cation, and wherein the metal cation is one of the alkali metals, earth alkali metals or ammonium.

6. The separation fluid (330) of claim 4, wherein the carboxylate salt is the corresponding Lewis-base of the used carboxylic acid.

7. The separation fluid (330) of any one of the above claims, where in the passivation agent has a water solubility larger than 0.01 g per 100 g of water at 20 °C.

8. The separation fluid (330) of any of the above claims, wherein components of the separating mixture comprise 20 – 70 % and preferably 30 – 50 % by weight of carboxylic acid, up to 5 % and preferably 0.02 – 2 % by weight of passivation agent

and 0.05 – 10 % and preferably 0.5 – 5 % by weight of carboxylate salt, and 30 – 70 % and preferably 40 – 60 % by weight of water.

9. A method for the separation of a metal layer (30) from a further layer (20, 40) in a multiple layer material (10) comprising:
placing the multiple layer material (10) in a vat (310) comprising the separation fluid (330) of one of claims 1 to 8.

10. The method of claim 9, further comprising at least one of sieving or filtering (240) the separation fluid (330) with components of the multiple layer material (10) and thereafter sorting (260, 280) to obtain a first fraction of metal from the metal layer (30) and a second fraction of plastic from the polymer layer (20, 40).

11. The method of one of claims 9 or 10, wherein the separation is carried out at a temperature of between 20°C and 90°C and preferably at 70°C.

12. The method of any one of claims 9 to 11, wherein the separation fluid (330) has a pH value of between 1.5 and 5.

13. The method of any one of claims 9 to 12, wherein the multilayer material (10) comprises at least one metal layer, preferably an aluminium layer, and at least one polymer layer (20, 40), preferably consisting of polyester or polyolefin.

14. A method for recycling packaging material (300) comprising a multiple layer material (10) comprising at least one metal layer (30) and at least one further layer (20, 40), wherein the method comprises:
placing the packaging material (10) in a vat (310) comprising a separation fluid (330) of one of claims 1 to 8 to produce (260) a mixture of metal shreds from the metal layer (30), plastic shreds from the polymer layer (20, 40) and residual components.

15. The method of claim 14, further comprising sorting (280) and separating the metal shreds and the plastic flakes to produce metal particles.

16. A combination of an apparatus for the recycling of packaging material made from a multiple layer material (10), and a separation fluid (330) of one of claims 1 to 8 comprising:

a vat (310) having the separation fluid (330);

a transportation device for transporting the packaging material (10) into the vat (310); and

a sieving/filtration device (350) for removing (240) separated materials from the combination of the separation fluid (330) and the packaging material (10).