

Claims

1. A structured cross-channel packing element (12) for a column (10) for mass
5 transfer and/or heat exchange between a heavy and a light fluid phase,
wherein the structured cross-channel packing element (12) comprises at
least two adjacent layers (32, 32') made of expanded metal sheets each
comprising openings (40, 40', 40'', 40'''), which are surrounded and
separated from each other by separating elements (42), wherein at least
10 two of the at least two layers (32, 32') are arranged in the longitudinal
direction (V) of the packing element (12) parallel and in touching contact
with each other so that an open space (30) extending from one end to the
opposite end of the at least two layers (32, 32') is provided between them
so that at least one of the heavy and the light fluid phase may flow through
15 it, wherein the ratio between the average width (b) of at least 50% of the
separating elements (42) between adjacent openings (40, 40', 40'', 40''')
and the sheet material thickness (s) is at least 15, wherein the ratio
between the maximum distance (D) between at least two of the at least two
layers (32, 32') measured in the plane being perpendicular of the
20 longitudinal direction (V) and the average width (b) of the separating
elements (42) is at least 4, and wherein the ratio between the distance (u_1)
between two openings (40, 40''') being in the direction perpendicular to the
stretch direction of the expanded metal sheet adjacent to a separating
element (42) and the average width (b) of this separating element (42) is for
25 at least 50% of all separating elements (42) 4 to 6, wherein the distance (u_1)
is measured by determining the distance between the outermost point of
one side of the edge of an opening (40) in the direction perpendicular to the
stretch direction of the expanded metal sheet and the outermost point of the
same side of the edge of an adjacent opening (40''') in the same direction of
30 the expanded metal sheet, wherein the longitudinal direction of the packing

- element (12) is as defined in the specification, wherein the stretch direction of the expanded metal sheet is the direction being perpendicular to the longitudinal direction (V) of the structured cross-channel packing element (12), and wherein the average width (b) of a separating element (42) is
- 5 determined by dividing up the separating element (42) into individual sections $i=1, 2, 3 \dots n$ each having a section length d_i , wherein for each of the sections the shortest distance b_i between the adjacent edges within the sections is measured and the sum of the products $d_i \cdot b_i$ is divided by the sum of d_i to yield the average width b of the separating element (42).
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2. The structured packing element (12) according to claim 1, wherein at least 50%, preferably at least 75%, more preferably at least 80%, still more preferably at least 90%, yet more preferably at least 95% and most preferably all of the at least two layers (32, 32') are made of expanded
- 15 metal sheets and comprise periodic deformations (26, 28, 34), wherein the layers (32, 32') are oriented such that the periodic deformations (26, 28, 34) of the adjacent layers (32, 32') intersect in crisscross fashion with the periodic deformations (26, 28, 34) of the layers (32, 32') extending obliquely relative to the longitudinal direction (V), wherein each layer (32, 32')
- 20 contacts each of the adjacent layers (32, 32') at points of intersection between the periodic deformations (26, 28, 34) of the layer (32, 32') and those of the adjacent layers (32, 32') and wherein the open space (30) between the at least two layers (32, 32') is defined by the periodic deformations (26, 28, 34).
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3. The structured packing element (12) according to claim 1 or 2, wherein the ratio between the distance (u_1) and the average width (b) of at least 75%, more preferably of at least 80%, still more preferably of at least 90%, yet more preferably of at least 95% and most preferably of all separating
- 30 elements (42) is 4 to 6, preferably 4.5 to 5.5 and more preferably 4.9 to 5.1.

4. The structured packing element (12) according to any of the preceding claims, wherein for at least 50%, preferably for at least 75%, more preferably for at least 80%, still more preferably for at least 90%, yet more preferably for at least 95% and most preferably for all openings (40, 40', 40'', 40''') the distance (u_1) is 5 to 20 mm, preferably 7.5 to 15 mm and more preferably 9 to 11 mm.
5. The structured packing element (12) according to any of the preceding claims, wherein the ratio between the distance (u_2) between a first opening (40) and a second opening (40') being in the stretch direction, which is the direction perpendicular to the longitudinal direction (V), of the expanded metal sheet adjacent to each other and the distance (u_1) between the first opening (40) and a third opening (40'') being in the direction perpendicular to the stretch direction of the expanded metal sheet adjacent to each other is 0.4 to 0.7, wherein the distance (u_2) is measured by determining the distance between the outermost point of a side of the edge of the first opening (40) in the stretch direction of the expanded metal sheet and the outermost point of the same side of the edge of the adjacent second opening (40') being adjacent in the stretch direction of the expanded metal sheet, and wherein the distance (u_1) is measured by determining the distance between the outermost point of one side of the edge of the first opening (40) in the direction perpendicular to the stretch direction of the expanded metal sheet and the outermost point of the same side of the edge of the adjacent third opening (40'') in the same direction of the expanded metal sheet.
6. The structured packing element (12) according to any of the preceding claims, wherein for at least 50%, preferably for at least 75%, more preferably for at least 80%, still more preferably for at least 90%, yet more

preferably for at least 95% and most preferably for all openings (40, 40', 40'', 40''') the ratio between the distance (u_2) and the distance (u_1) is 0.4 to 0.7, preferably 0.45 to 0.70 and more preferably 0.49 to 0.55.

- 5 7. The structured packing element (12) according to any of the preceding claims, wherein for at least 50%, preferably for at least 75%, more preferably for at least 80%, still more preferably for at least 90%, yet more preferably for at least 95% and most preferably for all openings (40, 40', 40'', 40''') the distance (u_2) is 2 to 8 mm, preferably 3 to 7 mm and more preferably 4 to 6 mm.
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8. The structured packing element (12) according to any of the preceding claims, wherein the average width (b) of at least 50%, preferably of at least 75%, more preferably of at least 80%, still more preferably of at least 90%, yet more preferably of at least 95% and most preferably of all separating elements (42) between adjacent openings (40, 40', 40'', 40''') is 1.5 to 4 mm, preferably 1.6 to 3.5 mm and most preferably 1.8 to 3.0 mm.
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9. The structured packing element (12) according to any of the preceding claims, wherein the ratio between the average width (b) of at least one separating element (42) between adjacent openings (40, 40', 40'', 40''') and the sheet material thickness (s) is at least 18.
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10. The structured packing element (12) according to any of the preceding claims, wherein between at least 50%, preferably between at least 75%, more preferably between at least 80%, still more preferably between at least 90%, yet more preferably between at least 95% and most preferably between all of the at least two layers (32, 32') the ratio between the maximum distance (D) measured in the plane being perpendicular of the
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longitudinal direction (V) and the average width (b) of the separating elements (42) is 4 to 15, preferably 5 to 13 and most preferably 8 to 12.

11. The structured packing element (12) according to any of the preceding
5 claims, wherein for at least 50%, preferably for at least 75%, more preferably for at least 80%, still more preferably for at least 90% and yet more preferably for at least 95% of the at least two layers (32, 32') the ratio of the total area of the openings (40, 40', 40'', 40''') divided by the sheet area (A_s) of the layer (32, 32') is between 20% and 38%, preferably
10 between 25% and 35% and most preferably between 28% and 32%.
12. The structured packing element (12) according to any of the preceding claims, wherein at least 50%, preferably at least 75%, more preferably at least 80%, still more preferably at least 90%, yet more preferably at least
15 95% and most preferably all of the openings (40, 40', 40'', 40''') have a shorter characteristic length (e₂) of the openings (40, 40', 40'', 40''') of 1 to 4 mm and preferably 2 to 3 mm and a longer characteristic lengths (e₁) of 2 to 8 mm, preferably 2.5 to 7 mm and most preferably 3 to 6 mm, wherein the shorter characteristic length (e₂) of an opening (40, 40', 40'', 40''') is the
20 maximal dimension of the opening (40, 40', 40'', 40''') in the stretch direction of the expanded metal sheet and the longer characteristic length (e₁) of an opening (40, 40', 40'', 40''') is the maximal dimension of the opening (40, 40', 40'', 40''') in the direction perpendicular to the stretch direction of the expanded metal sheet.
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13. The structured packing element (12) according to any of the preceding claims, wherein for at least 50%, preferably for at least 75%, more preferably for at least 80%, still more preferably for at least 90%, yet more preferably for at least 95% and most preferably for all of the openings (40,
30 40', 40'', 40''') the ratio between the shorter characteristic length (e₂) of an

opening (40, 40', 40'', 40''') and the longer characteristic length (e_1) of the same opening (40, 40', 40'', 40''') is 0.4 to 0.7, preferably 0.45 to 0.6 mm and most preferably 0.49 to 0.55 mm.

- 5 14. Mass transfer column comprising at least one structured packing element (12) according to any of the preceding claims.
15. Use of a structured packing element (12) according to any of claims 1 to 13 for the mass transfer and/or heat exchange