Skin Marker

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Skin Marker

Supplementary paper for IZI Medical Products, USA:

Testing of modified marker compound for X-Ray, MRI and CT acquisitions

Date of report: 02nd May 2013

Date of tests: 15th Feb 2013

Multimodal skin marker test: Feb 15th 2013

Table 1. Data visually observed with WC/WW settings at CT brain default (40/80) for MRI images and as import setting for CT and CRT.

		T1-tse	T2-tse	T1-Fl2d	T2-Fl2d	stir	Pd+T2-tse (fr1-30)	Pd+T2-tse (fr31-60)	CT	CRT
Control	Cod liver oil capsule	√	√	√	√-F	√-F	√	√	N/A	N/A
A		√	√-F	x	x	√	√	√	√	√
B		√	√-F	x	x	√	√	√-F	√	√
C		√	√-F	x	x	√	√	√-F	√	√
D		√	√-F	x	x	√	√	√-F	√	√
E		√	√-F	x	x	√	√	√-F	√	√
F		x	x	x	x	x	x	x	√	√
G		√	√	√	√-F	√	√	√	√	√
H		x	x	x	x	x	x	x	√	√
	WC/WW setting	40/80	40/80	40/80	40/80	40/80	40/80	40/80	40/80	512/1024

Table 2. Data visually observed with WC/WW settings at import setting for MRI, CT and CRT.

		T1-tse	T2-tse	T1-Fl2d	T2-Fl2d	stir	Pd+T2-tse (fr1-30)	Pd+T2-tse (fr31-60)	CT	CRT
Control	Cod liver oil capsule	√	√	√	√-F	x	√	√	N/A	N/A
A		√	x	x	x	√	√	x	√	√
B		√	x	x	x	√	√	x	√	√
C		√	x	x	x	√	√-F	x	√	√
D		√	x	x	x	√-F	√-F	x	√	√
E		√-F	x	x	x	√-F	√-F	x	√	√
F		x	x	x	x	x	x	x	√	√
G		√	√-F	√-F	x	√	√	√-F	√	√
H		x	x	x	x	x	x	x	√	√
	WC/WW setting	1182/2684	994/2033	1245/2619	522/1057	567/1172	1410/2900	1410/2900	40/80	512/1024

KEY	√ - visible	√-f – visible but faint	X – not visible

Location of markers

		Frame (1-30)	Pd+T2-tse (fr31-60)	Position
Control	Cod liver oil capsule	1,2	32-34	centre
A		25-27	56-58	RHS
B		20-22	51-53	RHS
C		15-17	46-48	RHS
D		9-12	40-43	RHS
E		5-7	36-38	RHS
F		N/A	N/A	N/A
G[1]		14-20	45-51	LHS (cluster) and centre (single)
H		N/A	N/A	N/A

The following images provide indicative visibility of the markers. It focuses on the best performing marker overall which is marker G. Note that this marker had a number clustered together therefore making a 'lumpy' type contracts image with artefacts (air gaps) evident.

- Figures 1 and 2 illustrates the array of markers in CRT and CT, clearly visible.
- Figures 3 and 4 illustrate a poorer performing setting example (T1-Fl2d) on import and then the enhancement adjustment setting (CT).
- Figures 5 and 6 illustrate the marker clearly visible using the STIR setting, which is notable as the control marker (the widely used cod liver oil capsule) is invisible on import (fig 7) or very faint under CT adjustment settings (Fig 8).
- Figures 9 and 10, illustrate the T1 import setting for both the control and Marker G, as a comparison using a successful visibility setting for both markers.

It was noted that there was a partial volume effect due to the size of the single markers (i.e.) the MRI slides only partially captured these with the diameter of 10mm and height 5mm. An increase to 15 or 20mm diameter would be appropriate. Figure 11 illustrates a single marker G encapsulated in a black external shell, which is visible in Moiré fringe based 3D scanning. Figures 12 and 13 contain minced markers within a cluster format to increase the volume.

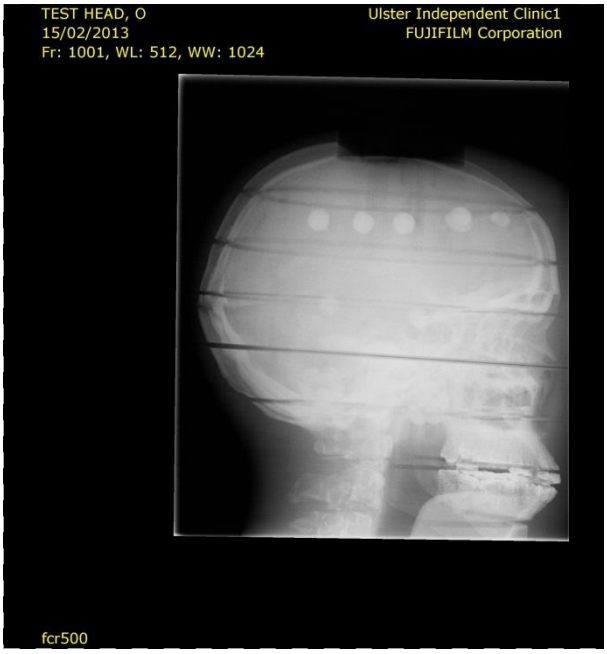

Fig 1. CRT image

Fig 2. CT Image

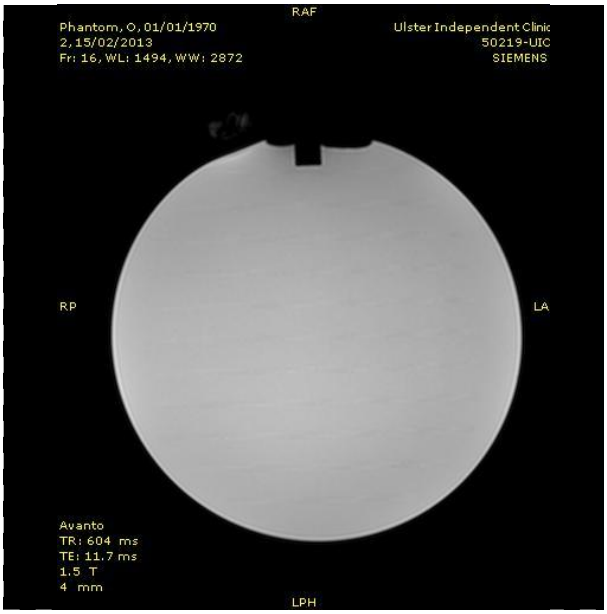

Fig. 3 Marker G- T1-Fl2d (import setting: faint)

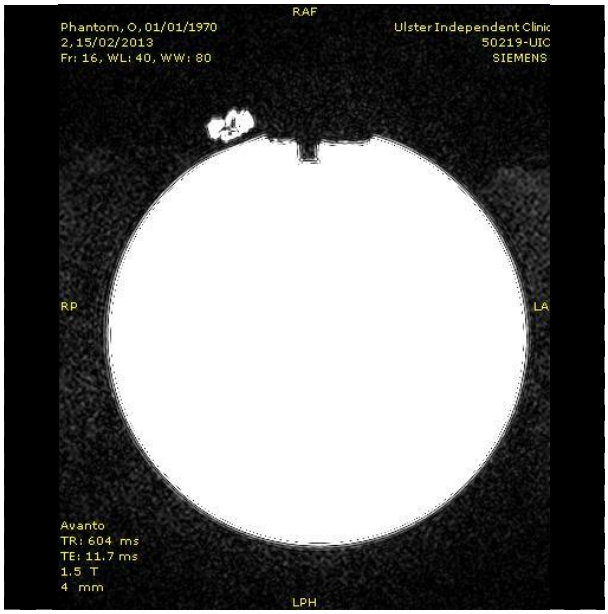

Fig. 4 Marker G- T1-Fl2d (CT setting)

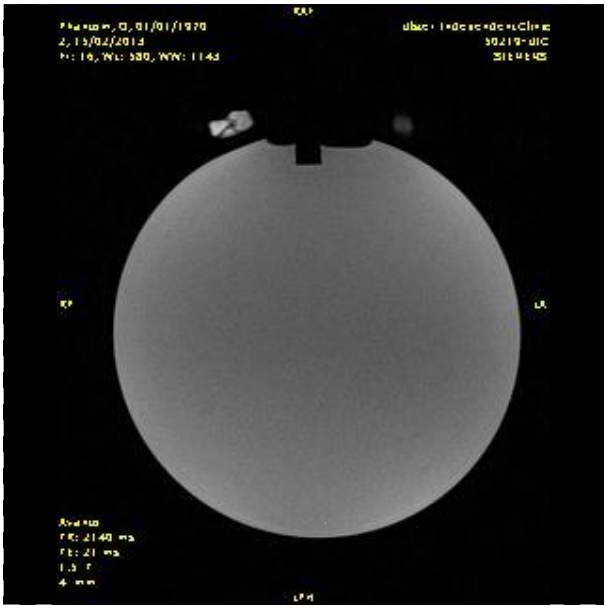

Fig. 5 Marker G-STIR (Import setting)

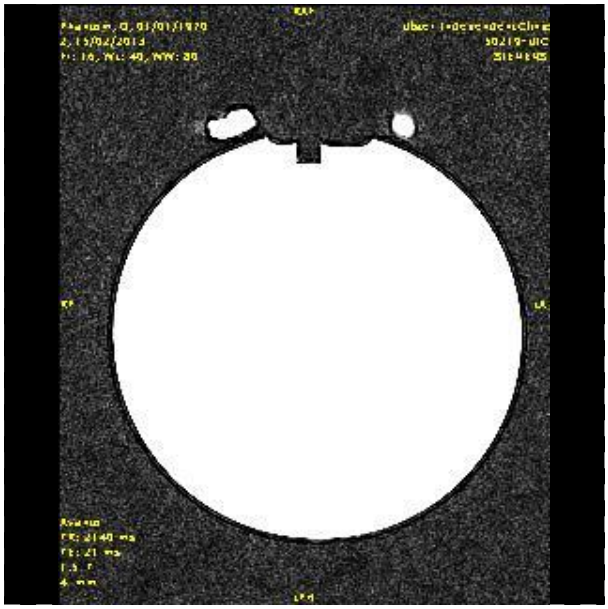

Fig. 6 Marker G-STIR (CT setting)

Fig. 7 Control marker – STIR (Import setting)

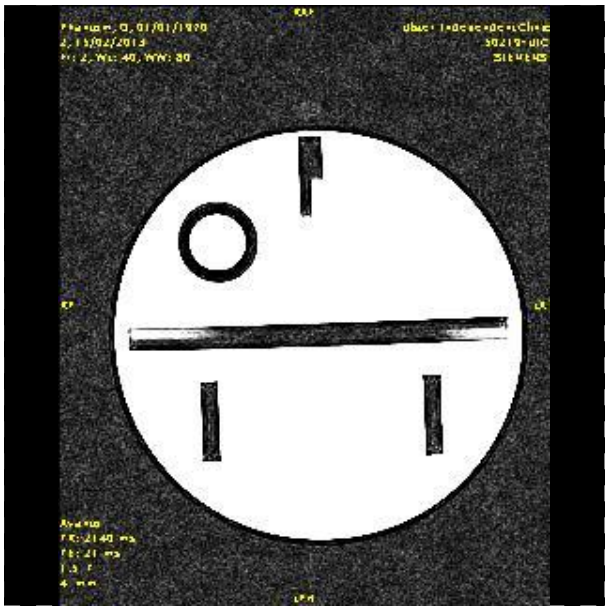

Fig. 8 Control Marker – STIR CT setting

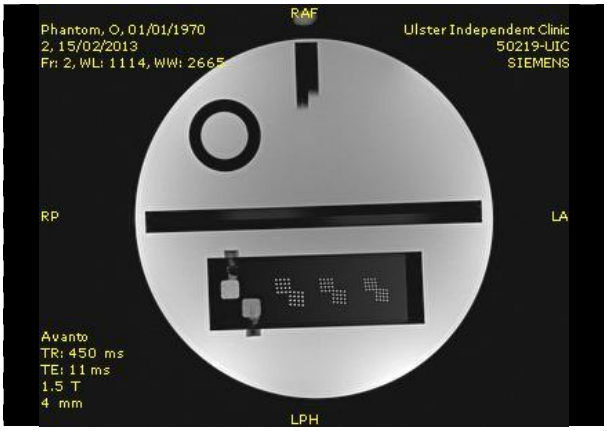

Fig. 9 Control Marker (T1 – import setting)

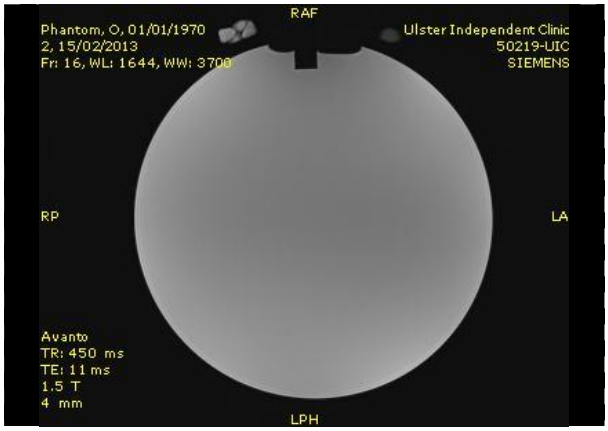

Fig. 10 Marker G (T1- import setting)

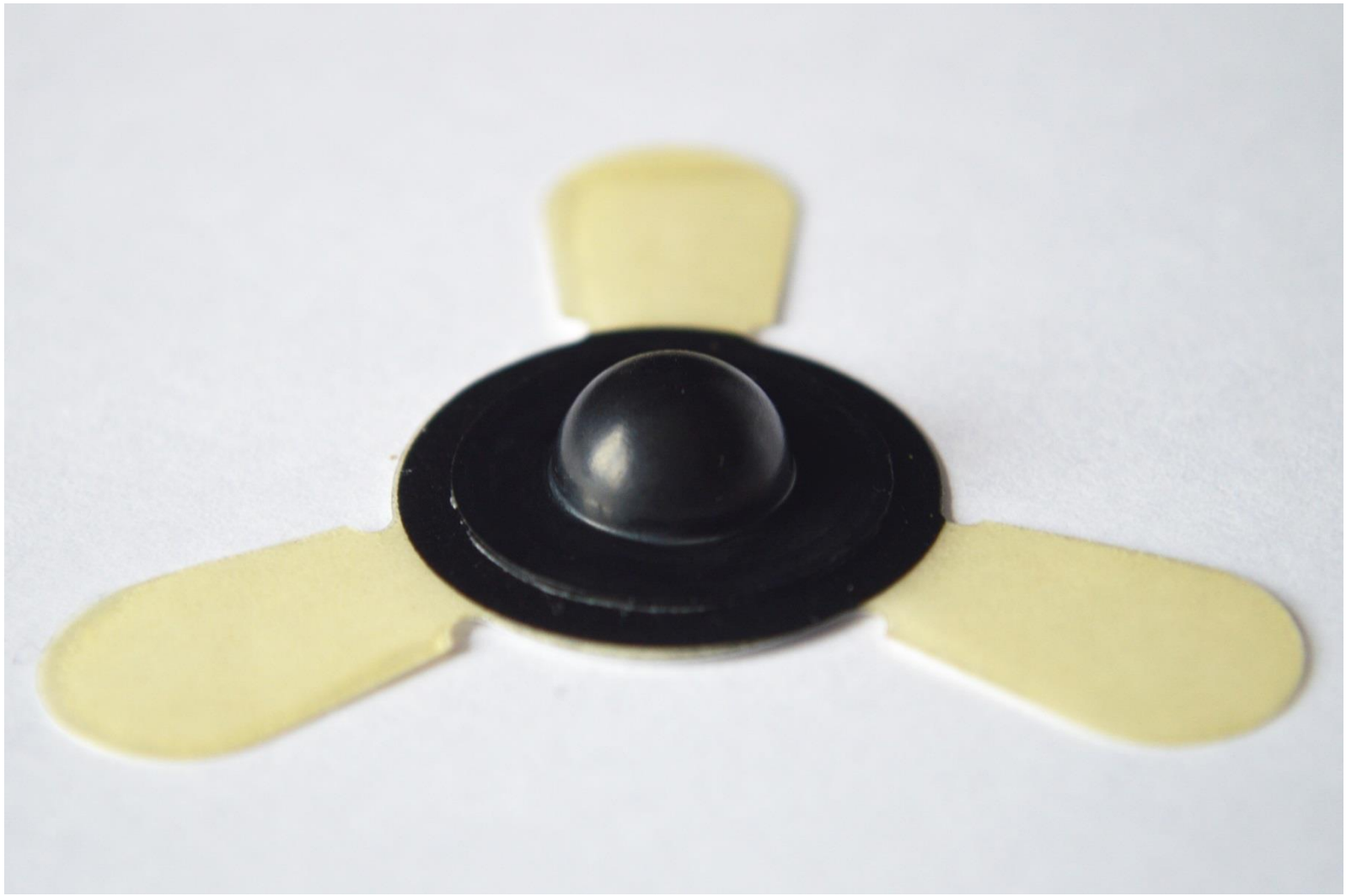

Fig. 11 Single marker 10mm diameter

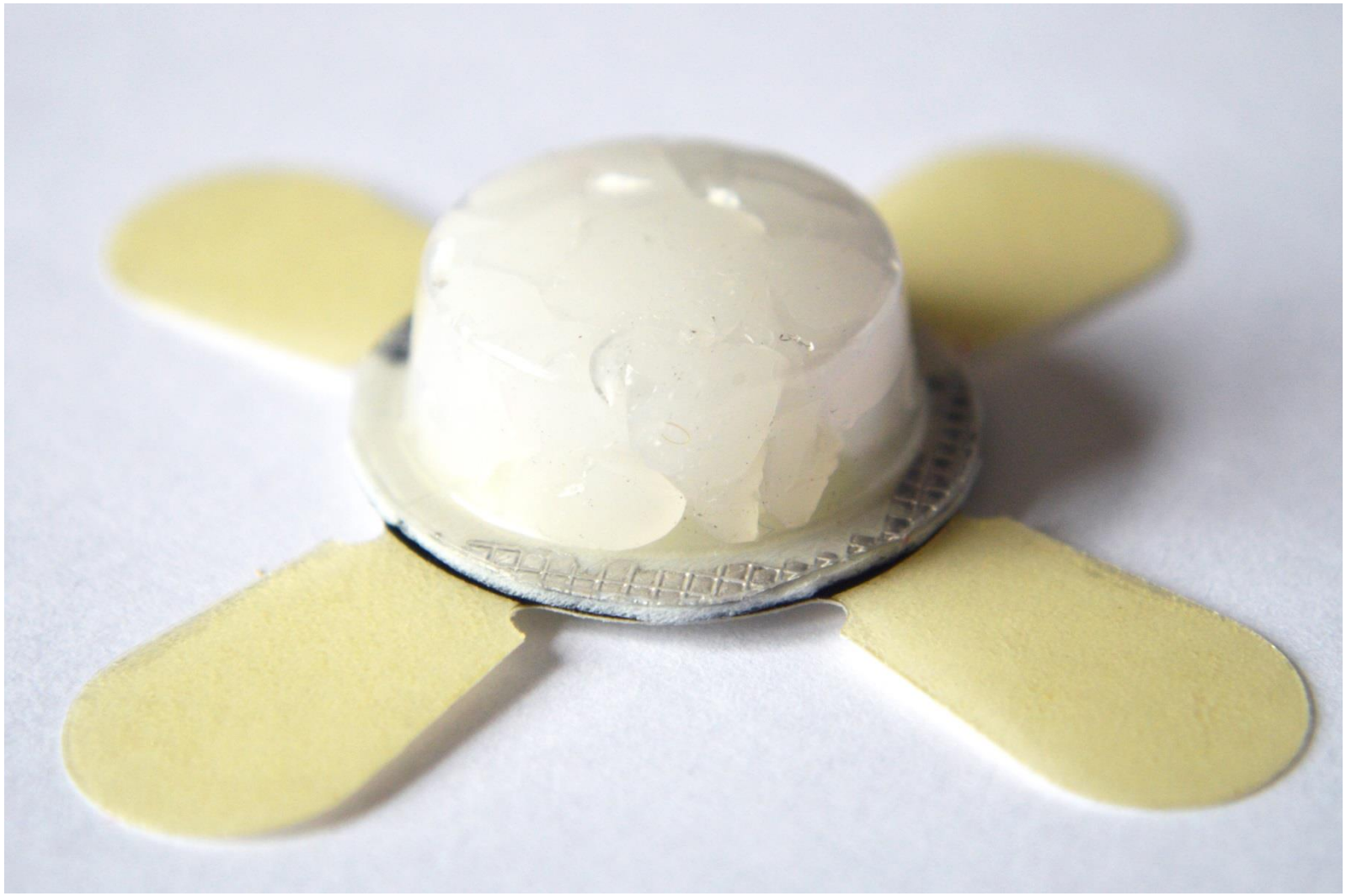

Fig. 12 Cluster marker

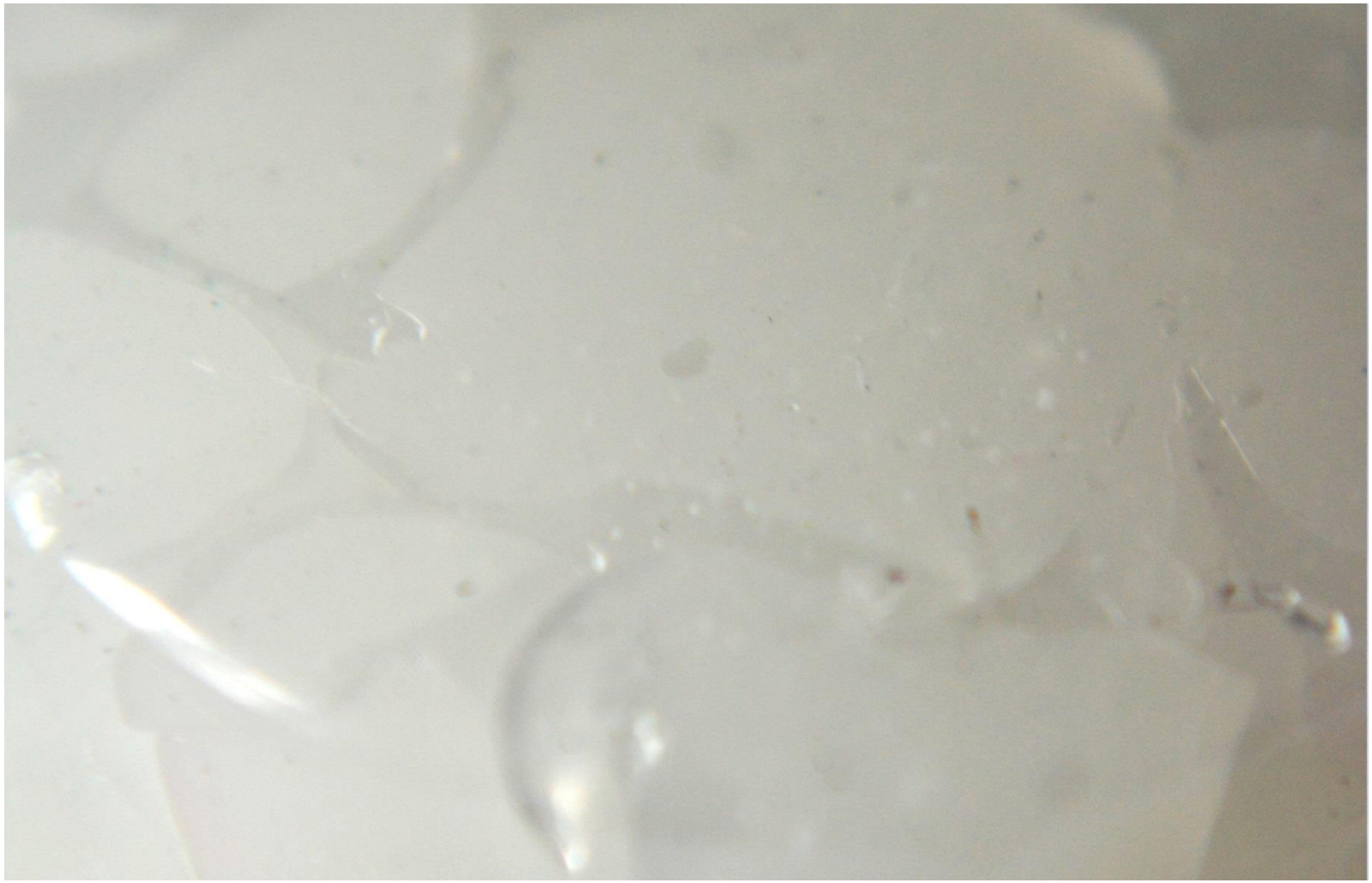

Fig. 13 Cluster marker close up showing air spaces