X-PARTITION_TRACERS_060428_M12.XLS
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Date: 2006-04-28

Re.: **EVALUATION OF "NEW" WEIGHTED, TRANSLUCENT X-RAY LUMINESCENT TRACER SAMPLES SUPPLIED BY PARTITION ENTERPRISES (PTY) LTD**

FLOW SORT RECEIVED A BATCH OF LUMINESCENCE TRACERS TO ESTABLISH THEIR SUITABILITY OF USE ON FLOW SORT X-RAY DIAMOND RECOVERY MACHINES.

1. The sample consisted of 2 batches. One batch of 4mm x 4mm x 4mm cubes and another batch of 8mm x 8mm x 8 mm cubes.

2. Each tracer contained a cylindrical "heavy" metal core, typically placed in the 'long' diagonal of the cube.

3. Both batches were grouped into 7 lots. Each lot was made up of 4 tracer samples of specific luminescence intensity.

4. Tracers are color coded, a different color being allocated to specific luminescence intensity.

5. Luminescence intensity levels are not quoted as specific intensity values such as lm, lx, erg, etc. but rather as intensity levels relative to each other. The range starts with an arbitrary level of 100 and each successive group with a level of half of the previous one.

6. The intensity grouping are as follows:

    a. Lot # 1 Color VIOLET = luminescence intensity level 100
    b. Lot # 2 Color PINK = level 50
    c. Lot #3 Color BROWN = level 25
    d. Lot # 4 Color BLUE = level 12.5
    e. Lot # 5 Color GREEN = level 6.25
    f. Lot # 6 Color YELLOW = level 3.125
    g. Lot # 7 Color ORANGE = level 1.5625

7. The entire sample was passed through a FLOW SORT X-RAY DIAMOND RECOVERY MACHINE MODEL XR 2/50 DW. The tracer signal was recorded for each tracer. The signals were converted into luminescence values measured in lumen.

    a. As reference we have also passed Flow Sort Marble Tracers and recorded their respective responses.

    b. Test results as tabled below are pretty much self-explanatory. I would however like to add the following explanations:
        i. Actual tracer luminescence values as obtained by our sorter do not exactly follow the "relative" luminescence scale as provided by

Partition Enterprises. The reason for this deviation is the "spectral-biased" attenuation of the tracers luminescence caused by its own color pigments.

ii. Variations in tracer luminescence levels reaching our sorters PMT's are mainly due to variations in the tracers' metal core orientation relative to x-ray source and optical detection plane.

iii. The reason for the smaller 4mm tracers being in some categories seen 'brighter' then the larger more voluminous 8mm tracers is also explainable as set out in i.) and ii) above.

8. **It is important to understand, that effects as explained above, do in no way lower the usefulness of these tracers for use with Flow Sort X-ray machines!** We found all Partition Enterprises new tracer samples that we tested to have accurate luminescence properties.

9. When using these tracers on Flow Sort x-ray diamond recovery machines it is however important to understand and work with the correct luminescence level which these tracers present in Flow Sort machines.

10. These new tracers, developed by Partition Enterprises, represent a much better diamond equivalent when it comes to luminescence properties than other such tracers currently on the market.

11. We recommend and wish to encourage all users of Flow Sort machines to immediately switch to this type of tracer or to Flow Sort Marble tracers rather than any other types.

12. As test results show the **BLUE** (4mm 4B and 8mm 4A) type is a direct replacement for Flow Sort Marble Tracers. A Flow Sorter set up to recover 100% Flow Marbles must be set-up to recover a "solid" 100 out of 100 of this tracer.

    a. Please consult with Flow Sort before making changes

13. Test results show the **GREEN** (4mm 5B and 8mm 5A) type as a further "direct" replacement for Flow Sort Marble Tracers. The green tracers are slightly less luminescent than Marbles. A Flow Sort set up to recover 100% Flow Marbles must be set-up to recover 98 out of 100 of this tracer.

    a. **Please consult with Flow Sort before making changes**

14. **It is of utmost importance that these new type of tracers get immediately proper product codes assigned. This is essential for ordering and identification purposes. Referring to this product only as vaguely as "new tracer" etc. will lead not only to a lot of confusion but ultimately to disaster!**

15. Note that Flow Sort model XR 2/50 DW had no problem to recover all sample tracers right down to the ORANGE group which showed luminescence levels around 0.2 micro lumen.

    For years I keep on saying that with x-ray diamond recovery the problem is not to recover low luminescent diamonds (tracers) but rather to distinguish such from other luminescent minerals in the feed to the sorter! This seems to be a very difficult message to get across!

PARTITION ENTERPRISES NEW WEIGHTED TRANSLUCENT TRACER TEST SUMMARY

TESTS WERE CONDUCTED ON A FLOW SORT X-RAY DIAMOND RECOVERY MACHINE MODEL XR 2/50 DW

	TRACER TYPE and MAKE	TRACER SIZE in mm	TRACER COLOR	Relative luminescence intensity values	TRACER SIGNAL PEAK in µA	TRACER luminescence in µlm	TRACER luminescence in µlm
7B	Partition translucent cube with core	4 x 4 x 4	Orange	1.5625	1.1	0.26	0.22
7A		8 x 8 x 8			0.8	0.17	
6B	Partition translucent cube with core	4 x 4 x 4	Yellow	3.125	1.3	0.50	0.5
6A		8 x 8 x 8			1.1	0.50	
5B	Partition translucent cube with core	4 x 4 x 4	Green	6.25	1.3	1.40	1.5
5A		8 x 8 x 8			1.4	1.60	
8	Flow Sort translucent Marble Tracer	12 Ø	White	N/A	1.6	1.80	1.80
4B	Partition translucent cube with core	4 x 4 x 4	Blue	12.5	2.1	2.30	2.2
4A		8 x 8 x 8			1.9	2.00	
3B	Partition translucent cube with core	4 x 4 x 4	Brown	25	1.2	3.30	4.0
3A		8 x 8 x 8			1.6	4.70	
2B	Partition translucent cube with core	4 x 4 x 4	Pink	50	1.4	8.10	8.85
2A		8 x 8 x 8			2.1	9.60	
1B	Partition translucent cube with core	4 x 4 x 4	Violet	100	1.4	19.40	21.1
1A		8 x 8 x 8			1.7	22.70	

16. Partition Enterprises, under the direction of Chris Wood, has come a long way to design x-ray luminescent tracers for testing x-ray diamond recovery machines. This latest range of x-ray luminescent tracers comes very close to simulating the luminescence properties of a diamond. However there is room for further improvement. For us the ultimate, (diamond luminescence property simulating) x-ray luminescent tracer should to be:

    a. Spherical in shape (this makes their motion-characteristics more “diamond like”)

    b. Have a high modulus of elasticity (to make them bounce like diamonds)

    c. If it is necessary for an x-ray luminescence tracer to have the s.g. of a diamond so that it also serves at the same time as a density tracer, then the weighting of the tracer should be done in such a way that the weighting does not effect the tracers x-ray luminescence properties.

i. If the tracer weighting is done by adding a metal core then this core should be of a shape that always projects the same x-ray and light "shadow area' seen from the radiation source as well as from the sorters optics. I.e. A spherical tracer body with a centralized spherical metal core.

Peter WOLF