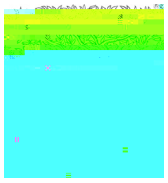


journal homepage: www.elsevier.com/locate/compscitech

$^{-2}$ ... 500 ... (1).

3. Characterization

... -7700 ... (-4600, ...). ... 980 ... (–980-2 ...). ... 1.5.

... 450, ... 36 ...

... -5016 ... 633 ... (050 ... A) ... 633 ... 633 ... (I), ... (I) ... (I) ... (θ) ... (2). ... (η) ...

$$\eta = \frac{I_d}{I_d + I_t} \quad (1)$$

... (I_s) ...

$$I_s = I - I_d - I_t - I_r \quad (2)$$

... I ... 633 ...

4. Results and discussion

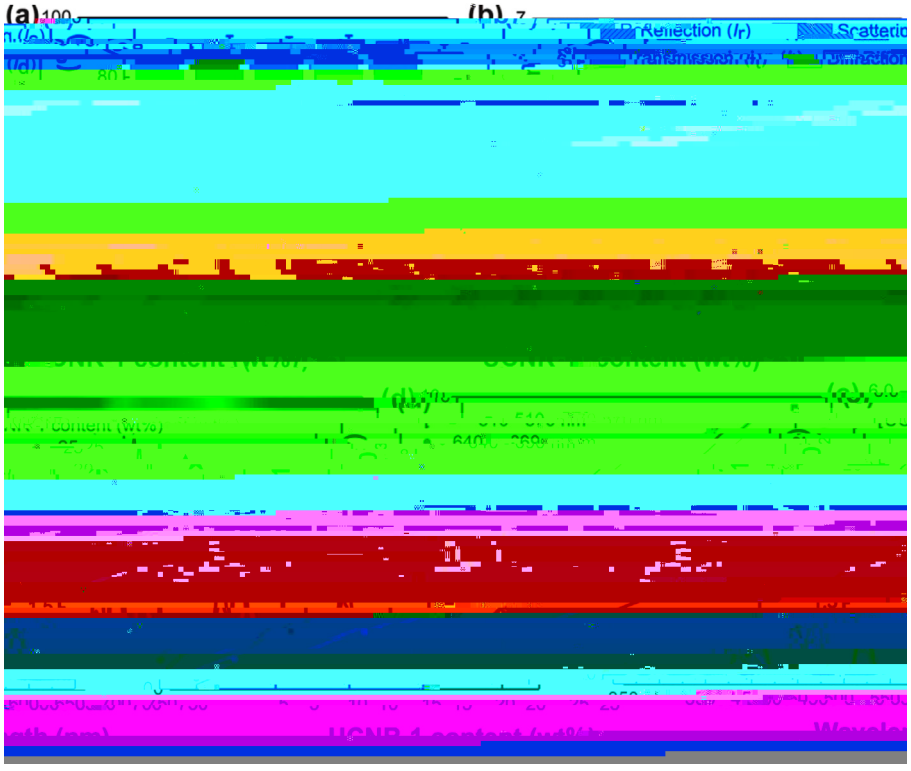
4.1. Characterization of UCNRs

... 4 ... (1.46–1.49) ... (1.47) [19,28]. ... (e.g., -1, -2 ... -3) ... [27]. ... $^{3+}$ ... [27], ... $^{3+}$ ... 60 % ... (e.g., $^{3+}$, $^{3+}$ ...

~30 s -1 , s - (. 4 . 6).

4.3. H l g a hic a.e i g

s fi s y s s(-) s. A / / ss s (10), s ss s (750) y s



28,39 .

5. Conclusions

Acknowledgments

(51773073, 51433002 51503045) ( ). (2016 A001) (2019 y 089, 2017 165, 2015 005). A & ( ) ffi A 46921, - 0010305 /10.1016/ .2019.107705.

Appendix A. Supplementary data

/10.1016/ .2019.107705.

References

1 . 70 (1) (2010) 1–19.