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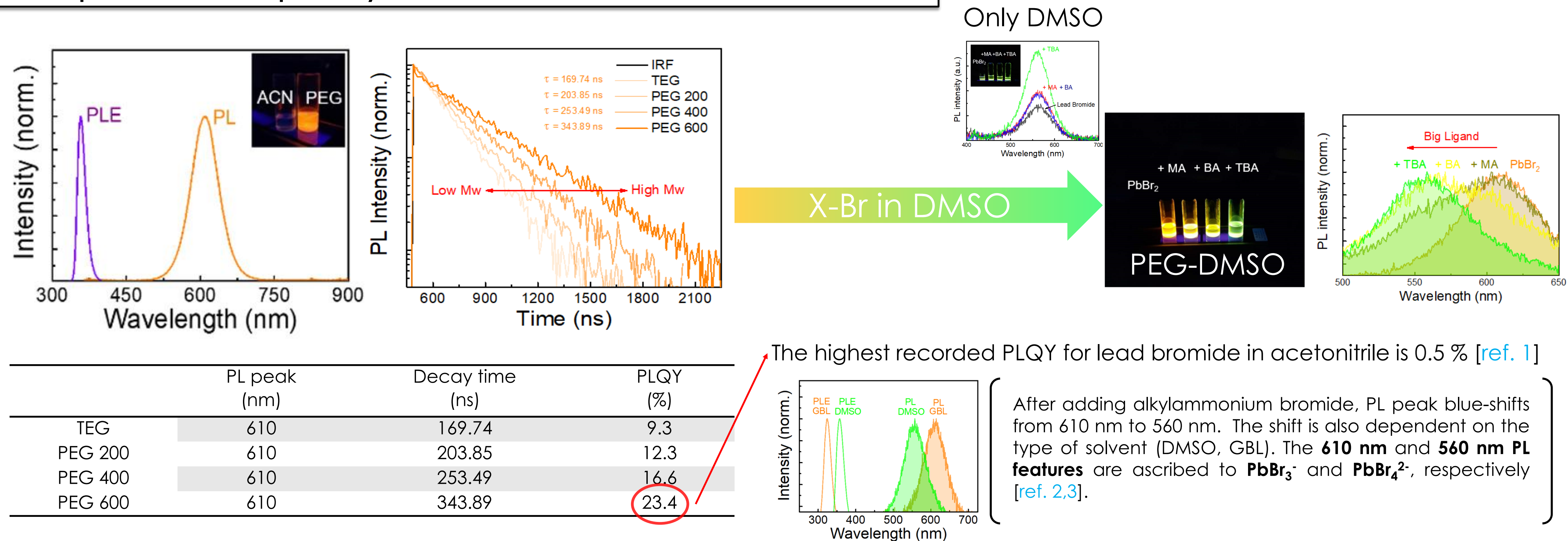
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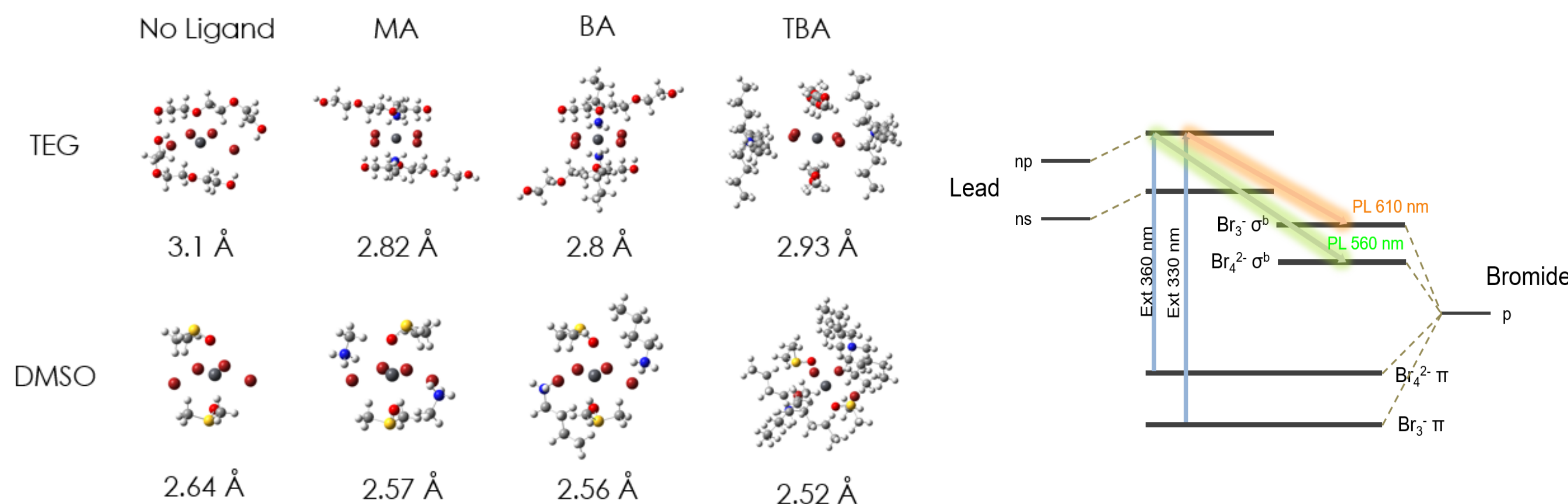
# Highly Luminescent Lead Bromide and Perovskite Solutions

As the emerging candidate for light-harvester and emitter, halide perovskites have shown huge progress due to their optoelectronic properties which stand out. However, this device performance is still highly dependent on defect passivation. Since defect state is rich in surface of perovskite grain, there have been enormous effort to suppress this defect. For instance, polyethylene glycol (PEG) with high molecular weight is a great passivator due to the electron lone pair in oxygen atom which can interact with the lead. Employing PEG boosts the electroluminescence of lead halide perovskite-based light-emitting diodes (PeLEDs) and light-emitting electrochemical cells (PeLECs). In addition, PEG liquid with low molecular weight dissolves lead halides as like conventional aprotic polar solvents, e.g. N,N-dimethylformamide (DMF) and dimethyl sulfoxide (DMSO). In this regard, we investigate lead bromide-PEG solution and there is augmented luminance (photoluminescent quantum yield over 20 %). The investigation regarding this abnormal luminescent property supports comprehensive understanding of lead halide – solvent complex and potential application exploiting ionized perovskite in solution.

## Optical Property of Lead Bromide in PEG



## Calculation



Pb-O distance / Software : Gaussian09      Scheme of PL-Mechanism

- The electrostatic interaction between PEGs and Ligand results in a reduced Pb-O distance
- DMSO has stronger interaction with Pb, hence the distance is smaller.
- Large ligands enhance the DMSO-Pb interaction and hence the 560 nm PL from PbBr<sub>4</sub><sup>2-</sup> species.
- Br (Ligand) to Pb (Metal) charge transfer (LMCT) likely responsible for the emission [ref.3].

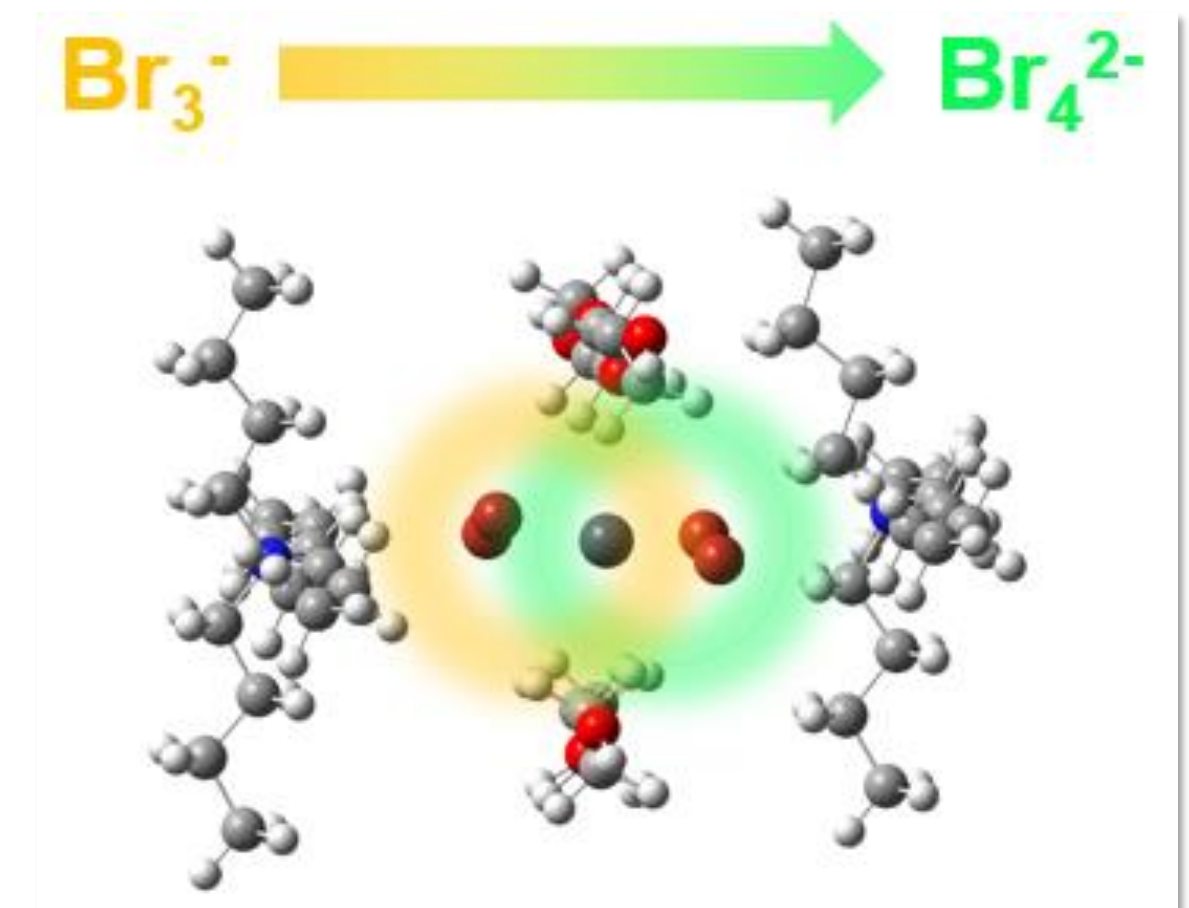
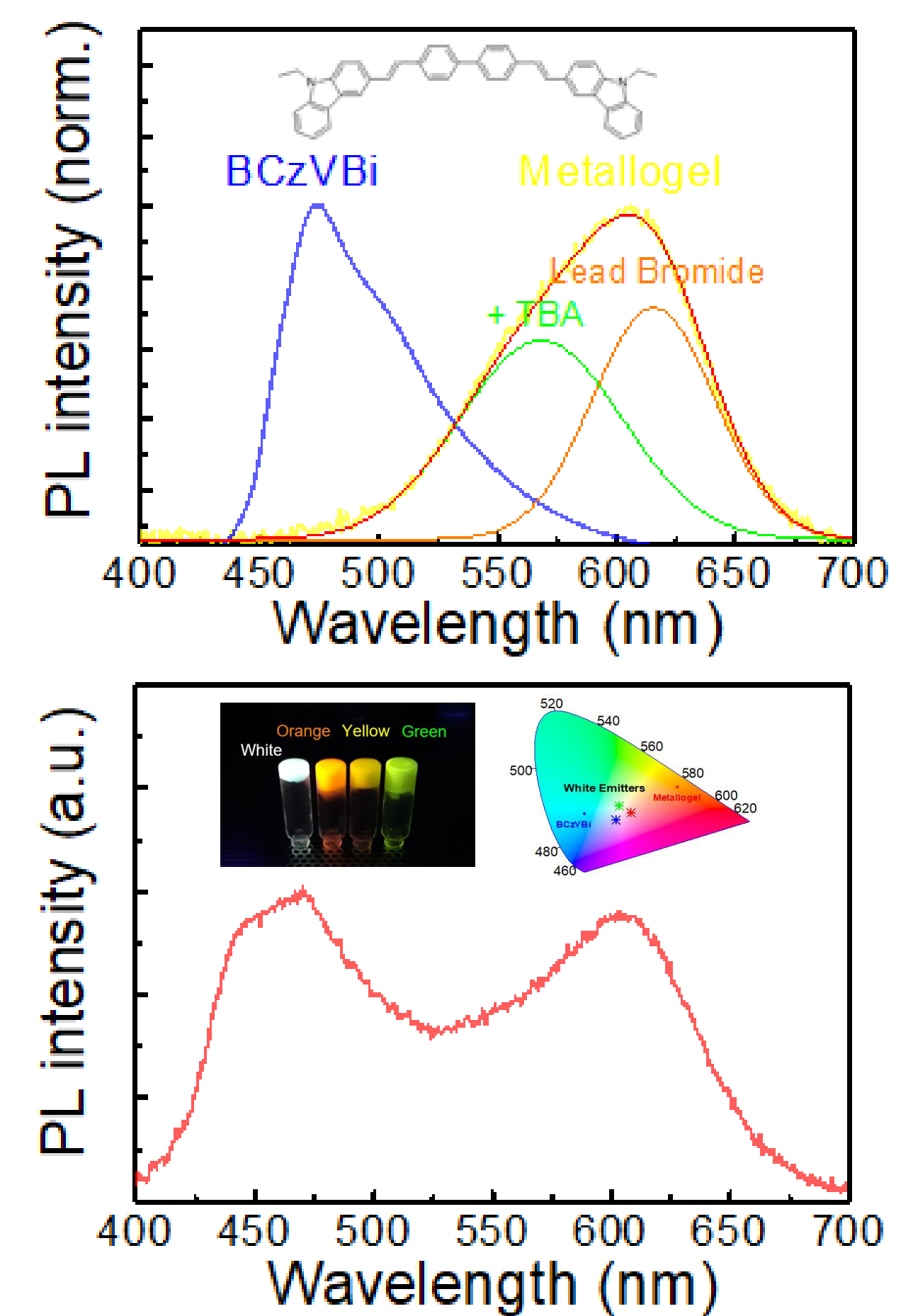
## Conclusions

- 1) Lead bromide-PEG solutions are highly luminescent (PLQY >23 %)
- 2) PL can be tuned by interaction with DMSO and alkylammonium ligands.
- 3) The alkylammonium halides provide excess halide anions, favoring formation of PbBr<sub>4</sub><sup>2-</sup> species upon interaction between Pb and DMSO.

## References

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## Application



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