**Stereoselective synthesis of a composite knot with nine crossings**

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**Background**

- Knots are fundamental elements of structure, exploited in basic tools and materials.
- Out of the 6 billion known knot formations, just four have been created by synthetic chemists, and they are all Prime Knots.

**Figure 1.** Synthesis of the most complicated topological isomers, the +3,#3,#+3, Composite Knot and 9² link.

**Synthesis of The Mixture**

- The self-assembly of six ligand 1 and six Fe(II) cations generates open helicate Fe₆₁⁺ after heating to 130°C for 24 hours.
- Following definition ring-closing metathesis of open helicate, fully closed isomers are generated.
- Demetallation is achieved by treatment with NaOH.

**X-Ray Crystal Structure**

Single crystals of Fe₆₁²⁺ are grown by solvent diffusion of isopropanol into a solution of mixture in acetone. The solid-state structure is determined by X-ray crystallography using the Diamond synchrotron source and refined by Maximum Entropy Method (MEM).

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**Characterization**

- The formation of open helicate Fe₆₁⁺, fully closed topological isomers Fe₆³⁺ and Fe₆⁵⁺, and organic mixture 2 and 3 are characterized by ¹H-NMR and ESI-MS.

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**Conclusion**

- The two most complicated topological structures: +3,#+3,#+3, Composite Knot and 9² link have been synthesized through cyclisation of a hexameric helicate. The composite knot Fe₆⁺ is separated and characterized by X-ray crystallography.