In the NaCl-LiF system [Fig. 11(b)] the situation is even more rich: We see that there are two frequency regions satisfying the criteria $\mathrm{Re}[\varepsilon_{eff}^{||}] < 0$ and $\mathrm{Re}[\varepsilon_{eff}^{\perp}] > 0$ (a narrow one from 5.3 to 5.7 THz, and a broader one from 9.2 THz up to around 12 THz – both highlighted with orange-shaded region) and one region where $\mathrm{Re}[\varepsilon_{eff}^{\perp}] < 0$ and $\mathrm{Re}[\varepsilon_{eff}^{||}] > 0$ (5.8 – 7.5 THz), offering thus great possibilities to tune the hyperbolic dispersion both in shape and frequency. This way, besides highly controlled superlensing, one can achieve other peculiar optical phenomena [41, 49, 50] like low-loss propagation, strong field confinement or expulsion, angle dependent polarization, frequency dependent propagation direction allowing the realization of beam splitters, etc., combined with the possibility to study or achieve many different optical responses using the same system.

6. Conclusions

In this work, using eutectics directional solidification, we have fabricated polaritonic eutectic systems made of LiF rods periodically placed in KCl and NaCl hosts, with varying system lattice size. These eutectic systems have been characterized experimentally and investigated theoretically, and it was shown that most of them behave as indefinite media (anisotropic uniaxial media with a negative permittivity component) in the THz regime and that the spectral range where this effect appears can be tailored by more than 1.5 THz, by selecting the appropriate lattice parameter for the eutectic (growth conditions). This opens the field for the search of other eutectic systems that provide different spectral windows and phenomenology.

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