Supporting information

**A- FTIR assignements on reference samples**

FTIR spectra were recorded on the pure AEP, Ca-AEP and Ca-$(AEP)_2$ precipitates reference samples. The spectrum of pure Ca-$(AEP)_2$ which is the stable complex corresponding to the pH of our preparation route, exhibit three bands assigned to the $PO_4$ vibration at 982.7 $cm^{-1}$, 1041 $cm^{-1}$ and 1099.3 $cm^{-1}$. This latter band is close to the asymmetric P-O-C stretching vibration reported at 1050 $cm^{-1}$. The region of 500 $cm^{-1}$ consisted of three bands at 485.4 $cm^{-1}$, 516 $cm^{-1}$ and 560.4 $cm^{-1}$. The bands at 741 $cm^{-1}$ can be attributed to the symmetric stretching of the P-O-C group. We can also observed the bands attributed to the symmetric (1533 $cm^{-1}$) deformation of $NH_3^+$. The band at 1455.6 $cm^{-1}$ is characteristic of the CH vibration.

FTIR spectra of pure calcium phosphate reference samples prepared without any incorporation of AEP were also recorded. The spectra display well defined typical vibrations of apatite mineral calcium phosphates over the region 500-700 $cm^{-1}$ suggesting that these samples prepared without AEP incorporation undergo some crystallisation.

## B- Table of $^{31}P$ , $^{1}H$ Chemical sifts, line widths of reference samples.

| Composition | $^{31}P$ Simple impulsion | | $^{31}P$ Cross Polarisation | | $^{1}H$ RMN | |
|---|---|---|---|---|---|---|
| | Chemical shift ppm | Line width ppm | Chemical shift ppm | Line width ppm | Chemical shift ppm | Line width ppm |
| AEP | δ= 0.76 84%<br>δ= 0.22 12%<br>δ= -0.17 3%<br>δ= -0.8 1% | 0.64<br>0.28<br>0.26<br>0.14 | | | | |
| Ca-AEP | δ= 4.10<br>δ= 1.84 | | δ= 3.99<br>δ= 1.77 | | δ= 4.94 | |
| Ca-$(AEP)_2$ | δ= -0.92 (89%)<br>δ= 3.06 (11%) | 0.57<br>1.96 | δ= -0.90 (100%) | 1.18 | δ= 9.41<br>δ= 4.94 | |
| Ca/AEP/Pm 3 / 0 / 0.25 non aged | δ= 2.86 | 2.35 | δ= 3.07 | | δ= 4.9<br>δ=1.06<br>δ= 0 | |
| Ca/AEP/Pm 3 / 0 / 1.00 non aged | δ= 2.92 | 1.96 | δ= 2.95 | | δ= 5.4<br>δ= 0 | 5.00<br>0.57 |
| Ca/AEP/Pm 3 / 0 / 2.00 non aged | δ= 2.90 | 1.99 | δ= 2.97 | | δ= 5.38<br>δ= 0 | 5.11<br>0.6 |