Supporting Information.

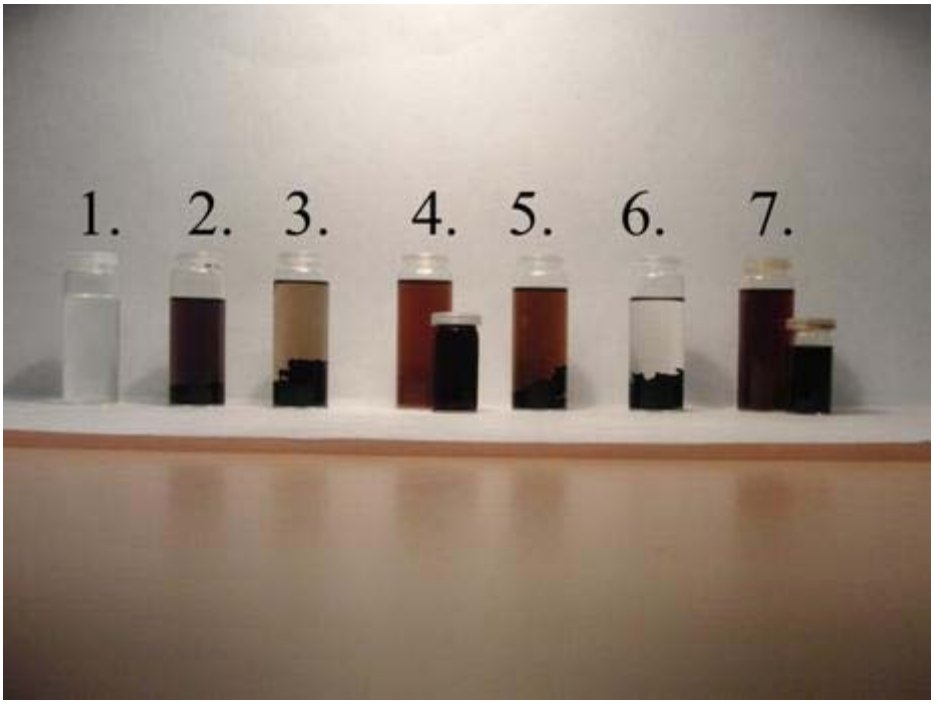

Figure 1. Swelling experiments

Samples after 24 hours in hexane, from left to right

1. pure PIP: dissolved
2. AuNP-crosslinked PIP: gel formation, partial dispersion
3. PdNP-crosslinked PIP: gel formation, partial dispersion
4. AgNP-crosslinked PIP, *low NP content*: dispersion (small glass: same concentration as the other samples, big glass: 10x dilution)
5. AgNP-crosslinked PIP,*slightly higher NP content*: gel formation, partial disperson
6. AgNP-crosslinked PIP,***saturation NP content***: complete crosslinking, complete gel, no dispersion
7. AgNP-crosslinked PIP, *high NP content*: gel formation, partial dispersion (small glass: same concentration as the other samples, big glass: 10x dilution)

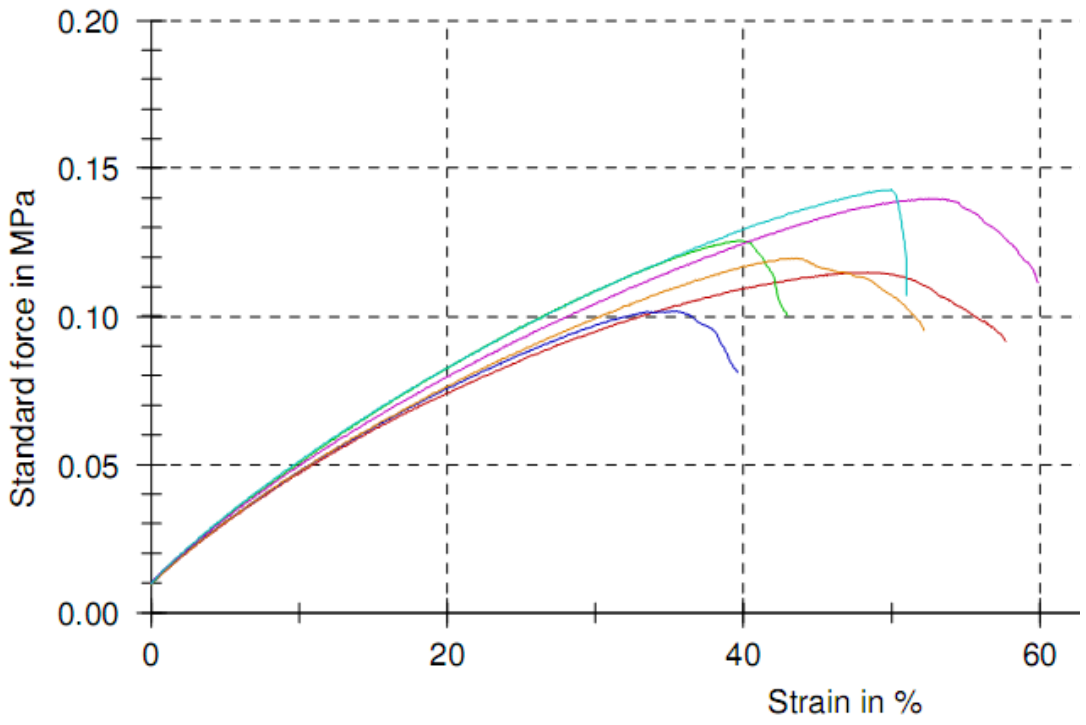

Figure 2. Example of a stress-strain measurement (Sample $PIP_{9210}Ag_{5.7}$). All samples showed a clear break and no flow.

Tests of antibacterial activity

Escherichia coli (*E. coli*, DSM No. 1077, K12 strain 343/113) was preserved on nutrient agar plates; a single colony was transferred with an inoculation loop to a nutrient solution of tryptic soy broth (Sigma Aldrich, aqueous solution c = 30 g/l) and incubated at 37 °C with shaking until the optical density at 578 nm had increased by 0.125. The suspension was diluted to an approximate concentration of 10^6 cfu/ml as inoculum; the exact cell density was determined by spreading serial tenfold dilutions on nutrient agar plates, incubation for 24 h at 37 °C followed by colony counting. To determine the antibacterial activity, specimens of approx. 1 x 1 cm size were placed on a nutrient agar plate previously inoculated with 100 µl inoculum and incubated at 37 °C for 24 h (Kirby-Bauer method). Furthermore, specimens of the same size were inoculated by spraying with bacteria suspension, placed on nutrient agar plated and incubated. The plates were visually evaluated for a zone of inhibition and colony formation on the sample's surface. To determine the number of viable cells on the material surface, the specimens were washed in sterile phosphate buffer, serial tenfold dilution in buffer solution were spread on nutrient agar plates, incubated at 37 °C for 24 h and evaluated for colony formation.

Kirby-Bauer (Figure 3) and spray-tests (Figure 4) revealed no bacteria growth on the sample containing AgNP, the blank control (PIP) in contrast was covered with colonies. Furthermore, no zone of inhibition had formed; it can be deduced that no leaching takes place within the measurement accuracy. Among the nutrient agar-plates inoculated with buffer solution to monitor the number of viable cells, there was no distinct difference in the number of colonies (Figure 5), i.e. the sample containing AgNP inhibits growth of *E. coli* on its surface, but the cells are not killed.

Figure 3. Kirby Bauer test of pure PIP_{9210} (lower right corner) and AgNP-crosslinked PIP (upper left corner, compound $PIP_{9210}Ag_{5.7}$). The AgNP-containing rubber did not show any bacterial growth on the material while the pure PIP is covered in colonies. It is also visible that no leaching took place with AgNP-crosslinked PIP.

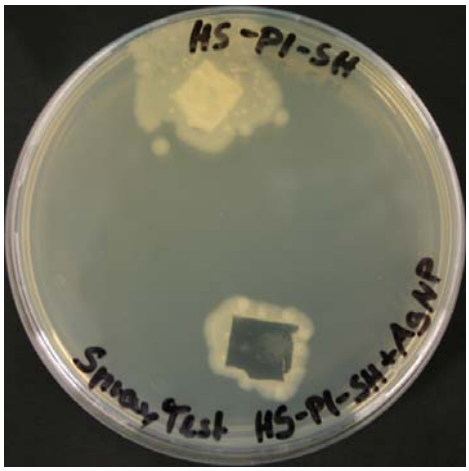

Figure 4. Spray test of pure PIP_{9210} (upper left corner) and AgNP-crosslinked PIP (lower right corner, compound $PIP_{9210}Ag_{5.7}$). The AgNP-containing rubber did not show any bacterial growth on the material while the pure PIP is covered in colonies. It is also visible that no leaching took place with AgNP-crosslinked PIP.

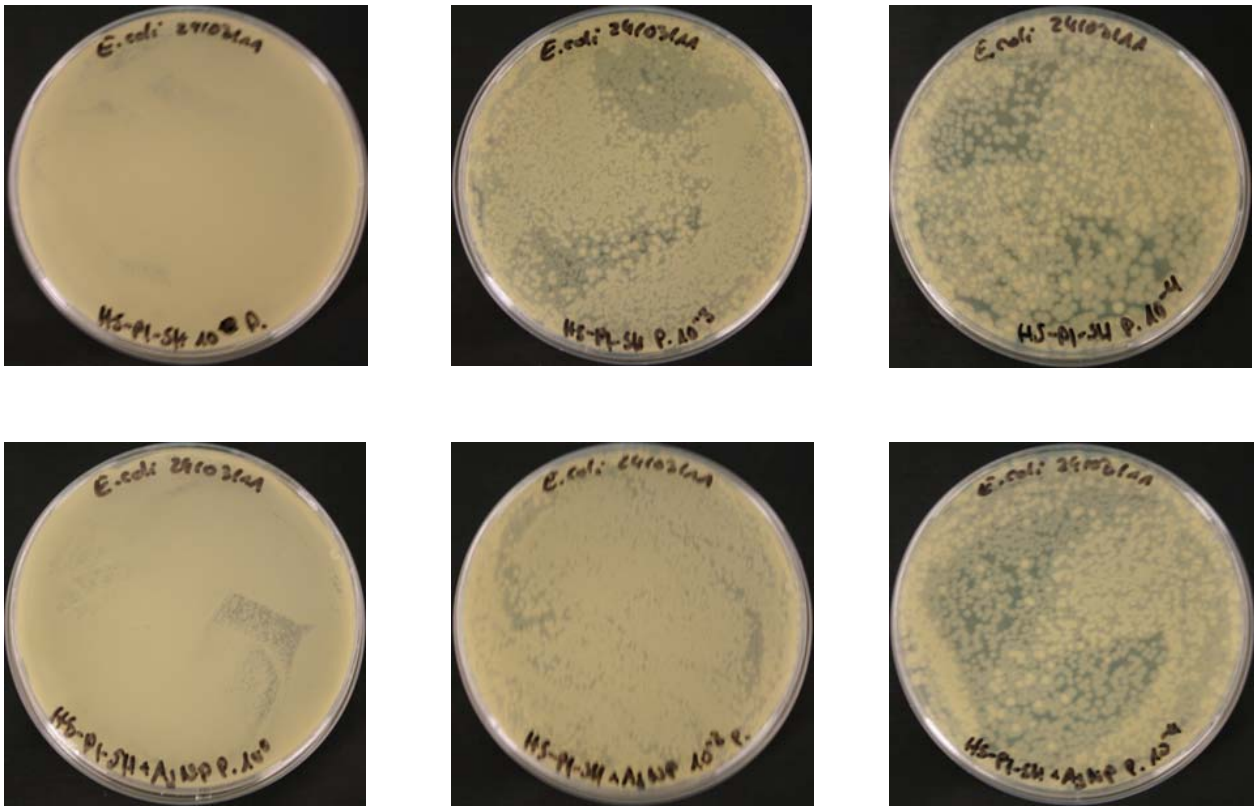

Figure 5. Determination of viable cells after antibacterial test (dilution series, upper three samples: PIP_{9210}, lower three samples: $PIP_{9210}Ag_{5.7.}$). There is no noticeable difference between both samples, which shows that the AgNP-crosslinked material does inhibit bacterial growth on the material but does not kill bacteria by leaching antibacterial compounds like silver salts.